VOL. 4 NO. 19
October 15, 1979

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ABSTRACTS 48038-49429

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Volume 4, Number 19, October 15, 1979
ISSN: 0160-3604
CODEN: ERABDZ

ENERGY RESEARCH ABSTRACTS

Published by the **Technical Information Center, Oak Ridge, Tennessee**
United States Department of Energy

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(BAW—10074A(Rev.1))
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The Secretary of the U. S. Department of Energy has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1978.

Volume 4, Number 19, October 15, 1979

ENERGY RESEARCH ABSTRACTS

COAL AND COAL PRODUCTS

REFER ALSO TO CITATION(S) 49424

PROCESSING

48038 (FE—2564-20) **Coal-oil slurry combustion demonstration. Phase I. Monthly report for January and February 1979.** (New England Power Co., Westborough, MA (USA)). Apr 1979. Contract EF-76-C-01-2564. 22p. Dep. NTIS, PC A02/MF A01.

The combustion of a coal-oil slurry in an 80 MW utility boiler originally designed to burn coal but not burning No. 6 oil will be demonstrated. New low pressure air atomized oil burners have been installed. The stability of coal-oil mixtures produced with various commercially available blending equipment has been investigated in the laboratory. Stability has also been evaluated using various dispersant additives. This work supported the selection of coal preparation and slurry blending equipment.

CARBONIZATION

48039 (COO—4553-2(Vol.1)) **Dry coke quenching final project report for Brown's Island Coke Plant, Weirton, West Virginia. Volume 1. Phase 1 engineering.** (Pennsylvania Engineering Corp., Pittsburgh (USA). Engineering Construction Div.). Aug 1978. Contract EC-77-C-02-4553. 80p. Dep. NTIS, PC A05/MF A01.

The subject of this report is the installation of a Dry Coke Quenching plant at National Steel's Brown's Island site. Although the technology of DCQ is not new, it has undergone much development and application in recent years to provide a process to: (1) recover the useful energy from the hot coke discharged from the coke-ovens; and (2) reduce the reported high levels of pollution from conventional quenching of hot coke using open water sprays. Although several modern installations have been built in the USSR and Japan, none has been built in the USA. With the sharply increasing prices of fuel and increasingly stringent environmental standards in the USA, the re-introduction of DCQ represents a double benefit for which the National Steel Plant will be a timely demonstration.

48040 (FE—1220-39(Vol.3)(Pt.2)) **Clean coke process: process development studies. Final report, Volume III-final process design & economics. Part 2: process economics.** (USS Engineers and Consultants, Inc., Pittsburgh, PA (USA)). Dec 1978. Contract EX-76-C-01-1220. 39p. Dep. NTIS, PC A03/MF A01.

An economic analysis was made of a Clean Coke facility designed to process 12.43 million tons per year of Illinois No. 6 coal. The product list included 3.6 million tons per year of formcoke pellets, 1.5 million tons of chemical products, and more than 33 trillion Btu of liquid fuel. With a total investment of $1.75 billion and with coke, chemicals, and fuels priced at $150 per ton, $256 per ton (average), and $2.50 per million Btu, respectively, a 14 percent return on investment was projected. By replacing Clean Coke hydrogenation with an SRC process variation and producing briquettes instead of pellets, the plant investment was reduced by $130 million, and the net result was an improvement in profitability, to a projected return of better than 15 percent. A final case involving production mainly of briquetted coke and fuels entailed a further $140 million reduction in plant investment. However, a revenue decrease of 22 percent over either of the other two cases resulted in significantly reduced profitability. Further analysis of the plant economics indicated that process profitability is particularly sensitive to coke value and that a price of $150 per ton is required under virtually all conditions and modifications to generate a minimum 15 percent return on the investment.

DESULFURIZATION AND PURIFICATION

48041 (IS—4701) **Selective magnetic enhancement of pyrite in coal by dielectric heating. Quarterly technical progress report, January 1, 1979—March 31, 1979.** Bluhm, D.D. (Ames Lab., IA (USA)). Jun 1979. Contract W-7405-ENG-48. 15p. Dep. NTIS, PC A02/MF A01.

The magnetic susceptibility of pyrite in coal is being enhanced by the use of selective pretreatments such as dielectric heating and chemical oxidation. Dielectric properties measurements were continued by selection of representative coals. Dielectric heating at 2.45 GHz has been done using a one-fourth height WR-340 slotted waveguide. Experiments on the parallel plate applicator that was developed for use at 27 MHz have not been successful. Measurements are now being continued over a broad range of the frequency spectrum since there may be an optimum frequency where pyrite may be heated significantly faster than coal. An AGA scanning infrared system was employed to dramatically illustrate the difference in rate of dielectric heating of coal and pyrite. Preliminary results show that there is a definite increase in mass susceptibility when Childers pyrite is subjected to microwave dielectric heating.

GASIFICATION

REFER ALSO TO CITATION(S) 48150, 48909, 48932, 48934

48042 (CONF-790480—1) **Long-term erosion monitoring of metallic conduits by ultrasonic pulse-echo techniques.** Youngdahl, C.A.; Ellingson, W.A. (Argonne National Lab., IL (USA)). 1979. Contract W-31-109-ENG-38. 12p. Dep. NTIS, PC A02/MF A01.

From 12. symposium on nondestructive evaluation; San Antonio, TX, USA (24 Apr 1979).

Erosion monitoring of metallic transfer lines and fittings in pressurized equipment used to process particulate matter, such as pulverized coal or ash, can prevent unexpected component failures and contribute to improved equipment designs. Nondestructive, ultrasonic pulse-echo techniques to detect erosion have been developed for high-temperature ($\sim$ 650°C) on-line measurements and applied to various stainless steel and carbon steel components of coal-gasification and liquefaction pilot plants. The techniques are described, together with successful methods of accounting for varying specimen temperatures, long monitoring times (months to years), and exposure of transducers and couplant to weather. Measurement characteristics peculiar to erosion monitoring are discussed.

48043 (DOE/RL/90476—13) **Investigation of the viability and cost effectiveness of solid fuel gasifiers close coupled to internal combustion engines for 200 kWe power generation. Technical progress report No. 9.** Mingle, J.G.; Junge, D.C. (Oregon State Univ., Corvallis (USA)). Jan 1979. Contract EY-76-S-06-2227-022. 53p. (RLO—2227-T22-13). Dep. NTIS, PC A04/MF A01.

The viability and cost effectiveness of a 200 kWe engine generator unit fueled by a direct coupled, solid fuel gasifier were studied. Recent literature describing gasifier technology was obtained and personal visits were made to test facility sites and engine manufacturing plants to discuss the subject with researchers and engineers. Two prototype units were inspected, one of which was in partial operation. This report presents a brief discussion of fuel and gasifier technology, gas treatment (clean up) for engine use, engine use technology, other uses for gasifiers, the viability of close coupled units, and an estimate of cost effectiveness. Present small experimental gasifier systems perform as expected and have served to demonstrate the technology. Typically they operate with fuel species which are present and collected on the site of a processing plant. Certain needed development efforts are discussed. Also, fuel must be available at low cost and even then electric power produced in this

way is unlikely to be competitive economically where utility poles are available. (LTN)

48044 (FE—2012-058) **Pipeline gas demonstration plant. Phase I. Quarterly technical progress report, December 1978—February 1979.** Eby, R.J. (Illinois Coal Gasification Group, Chicago (USA)). Mar 1979. Contract EF-77-C-01-2012. 46p. Dep. NTIS, PC A03/MF A01.

Overall work activity and progress have been curtailed by the limitation of available funds, problems related to process licensor subcontractng and the awaiting of a decision by DOE to continue the ICGG Pipeline Gas Demonstration Plant Program. The lack of adequate funding has caused a slowdown of selected work activities and the postponement of other efforts. The allotment of sufficient funds by DOE will eliminate this problem and permit the implementation of an effective work plan for the completion of Phase I of this Program. Work related to the definitive process design in Task II has been critically hampered and delayed by not obtaining process licensor data due to lack of DOE approval of these subcontracts. The resolution of this situation is vital to the completion of this task and subsequent tasks in this phase. ICGG has been working at less than an optimum rate pending a decision by DOE as to the continuation of Phase I. On January 23, 1979, DOE authorized ICGG to continue detailed design of the Demonstration Plant and to proceed with the completion of Phase I of the Program. With the decision for ICGG to proceed and predicated on the resolution of the subcontracting problems in conjunction with adequate funding by DOE, the project should progress in an orderly and effective manner.

48045 (FE—2276-27) **Development studies on selected conversion of synthesis gas from coal to high octane gasoline. Final report.** Brennan, J.A. (Mobil Research and Development Corp., Paulsboro, NJ (USA); Mobil Research and Development Corp., Princeton, NJ (USA)). Oct 1978. Contract EX-76-C-01-2276. 382p. Dep. NTIS, PC A17/MF A01.

An exploratory, experimental process study was conducted on the direct conversion of coal derived synthesis gas to gasoline. Novel, proprietary catalysts, supplied by Mobil Research and Development Corporation were used. These unique catalysts do not yield oxygenates and the hydrocarbons formed are limited in size to about C_{11}. Consequently, both gasoline selectivity and quality exceeds that of the gasoline produced in the Fischer—Tropsch process. This new technology was compared with conventional Fischer—Tropsch. The experiments were conducted in micro reactor (10 cc catalyst capacity) and in bench-scale units (150 cc catalyst capacity). The bench-scale unit was used in both a fixed and fluid bed mode. The studies included effects of temperature, pressure and space velocity on catalyst performance, and catalyst activation, aging and regeneration. Theoretical studies were made to support the process research. Mobil Research and Development Corporation has discovered a series of catalysts that will convert coal-derived synthesis gas to high octane number gasoline in selectivities higher than predicted by the Schultz—Flory equation. The process potential of these catalysts was assessed under Contract No. EX-76-C-01-2276, jointly funded by DOE and Mobil Research and Development Corp.

48046 (FE—2434-37) **Pipeline gas from coal - hydrogenation (IGT hydrogasification process). Project 9000 quarterly report No. 9, July 1—September 30, 1978.** (Institute of Gas Technology, Chicago, IL (USA)). Mar 1979. Contract EX-76-C-01-2434. 42p. Dep. NTIS, PC A03/MF A01.

The objective of this project is to perform the necessary pilot plant operations and related support studies to acquire data for a commercial/demonstration plant design based on the HYGAS Process. To this end, tests are being conducted with Illinois bituminous coal to acquire data for optimizing the process. In Test 74 the new steam—oxygen gas distributor and the fluidizing steam distributor were tested in the steam—oxygen gasifier for their effects on its operation. Temperature measurements below the steam—oxygen distributor indicate that at higher steam feeds to the fluidizing steam distributor, solids mixing was significantly improved. Twenty-one days of continuous self-sustained operation were logged, breaking all previous records and accumulating over 200 hours of steady-state operation. The entire HYGAS pilot plant was inspected following Test 74. Immediately after Test 74, the reactor and related piping and vessels were successfully pressure-tested at 1000 pounds as a preliminary procedure for Test 75 high-pressure operations. Additional data were supplied to Procon, Inc., to aid in its design of a commercial/demonstration HYGAS plant. Work continued on the cold-flow model of the upper stage of the HYGAS reactor, details of which are presented. Pretreater and gasifier material balances and engineering data from Test 70 are also included.

48047 (FE—2496-34) **Operation of a sampling train for the analysis of environmental species in coal gasification gas-phase process streams.** Pochan, M.J.; Massey, M.J. (Carnegie-Mellon Univ., Pittsburgh, PA (USA)). Feb 1979. Contract EX-76-S-01-2496. 56p. Dep. NTIS, PC A04/MF A01.

This report discusses the results of actual raw product gas sampling efforts and includes: Rationale for raw product gas sampling efforts; design and operation of the CMU gas sampling train; development and analysis of a sampling train data base; and conclusions and future application of results. The results of sampling activities at the CO_2-Acceptor and Hygas pilot plants proved that: The CMU gas sampling train is a valid instrument for characterization of environmental parameters in coal gasification gas-phase process streams; depending on the particular process configuration, the CMU gas sampling train can reduce gasifier effluent characterization activity to a single location in the raw product gas line; and in contrast to the slower operation of the EPA SASS Train, CMU's gas sampling train can collect representative effluent data at a rapid rate (~ 2 points per hour) consistent with the rate of change of process variables, and thus function as a tool for process engineering-oriented analysis of environmental characteristics.

48048 (FE—2496-40) **Status report: engineering contributions to coal gasification environmental analysis. Ninth quarterly report.** Massey, M.J.; Fillo, J.P. (Carnegie-Mellon Univ., Pittsburgh, PA (USA)). Oct 1978. Contract EX-76-S-01-2496. 26p. Dep. NTIS, PC A03/MF A01.

This report represents the third annual report of progress in the coordination of DOE Fossil Energy's environmental characterization activities at its coal gasification pilot plants. Participants in the program include Argonne National Laboratory (Hygas), Combustion Engineering (CE gasifier), the Grand Forks Energy Technical Center (slagging fixed bed gasifier), the Institute of Gas Technology (Hygas), Oak Ridge National Laboratory (gasifiers in industry), the Pittsburgh Energy Technical Center (Synthane), Phillips Petroleum (Bi-Gas), and Radian Corp. (C_2-Acceptor). Coordination and evaluation efforts are carried out by Carnegie-Mellon University with the assistance of its sub-contractor, Environmental Research and Technology, Inc. Substantial progress has been made by each of the listed participants during the past year; their work is extensively documented in a series of reports now available in the literature. The present report is devoted to a discussion of the evolving role of engineering in the generation of coal gasification environmental data bases. Significant engineering contributions to the program are highlighted here with supporting data.

48049 (FE—2729-5) **Alloy catalysts with monolith supports for methanation of coal-derived gases. Quarterly technical progress report, September 21, 1978—December 20, 1978.** Bartholomew, C.H. (Brigham Young Univ., Provo, UT (USA)). 5 Jan 1979. Contract EF-77-S-01-2729. 29p. Dep. NTIS, PC A03/MF A01.

Results from previously reported support geometry studies supplemented with recent calculations were summarized in a paper submitted to the American Institute of Chemical Engineers. Calculations of Thiele moduli, effectiveness factors and mass transfer coefficients for pellets and monoliths reveal that under reactor conditions monoliths are more active than pellets because of lower pore diffusion resistance and higher rates of film mass transfer. Long-term thermal degradation tests of high loading (20% nickel on alumina) indicate that the catalyst deactivates slowly at 723 and 773 degrees K. Deactivation is mainly due to sintering and carbon fouling. A new electron microscopy technique for measuring nickel crystallite size was developed. The estimate of nickel crystallite size obtained using this technique compare favorably with those from chemisorption data.

48050 (LBL—9177) **Extraction of phenols from coal conversion process condensate waters.** Greminger, D.C.; King, C.J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1979. Contract W-7405-ENG-48. 98p. Dep. NTIS, PC A05/MF A01.

Thesis.

Condensate water samples from two typical coal-conversion processes were analyzed for phenols by gas chromatography-mass spectrometry and high-performance liquid chromatography. Significant amounts of phenol, dihydroxybenzenes and the trihydroxybenzene phloroglucinol were found. The presence of a trihydroxybenzene is particularly important as trihydroxybenzenes are extremely resistant to biological oxidation. The effects of water-phase pH on the extraction equilibria of the weakly acidic phenols were studied in a series of pH-controlled batch extractions of phenol, resorcinol, and hydroquinone into diisopropyl ether (DIPE) and hydroquinone into methyl isobutyl ketone (MIBK). The equilibrium distribution coefficient K/sub D/ decreased sharply in the pH range typical of condensate waters, 8.7-9.8, which is also the range of the pK/sub a/'s of the phenols. A simple model combining the acid ionization and the phase distribution equilibria fit the data well. Batch extractions of di- and trihydroxybenzenes into MIBK and DIPE showed MIBK to be clearly a better solvent than DIPE. The distribution coefficients in MIBK were an order of magnitude greater than those in DIPE, some of which were much less than unity. DIPE is currently used in the Phenosolvan process to extract phenol from coke-oven and coal-conversion effluent waters. With the K/sub D/'s measured in this work, calculations showed that the Phenosolvan process, as currently run, will not remove polyhydroxybenzenes from alkaline water

solution to the levels required for further treatment, recycle or discharge of the condensate waters.

48051 (METC/SP—79/5) **Testing, evaluation, and development of valves for lockhopper services in coal conversion processes by the U.S. Department of Energy.** Gardner, J.F. (Department of Energy, Morgantown, WV (USA). Morgantown Energy Technology Center). Jun 1979. 39p. Dep. NTIS, PC A03/MF A01.

The U.S. Department of Energy, through the Morgantown Energy Technology Center (METC), has taken on the role of testing and developing valves for various severe service applications in coal conversion and utilization processes. Projects are currently underway for the development of prototype lockhopper valves through development contracts with testing and evaluation by METC. Additionally, a State-of-the-Art (SOA) Lockhopper Valve Test and Evaluation Project continues in an effort to develop modifications to currently available valve designs which will provide reliable, long-life components for existing pilot plants and early demonstration plant service. An overview including objectives and current status of each project will be presented.

48052 (PB—288630) **Applicability of petroleum refinery control technologies to coal conversion. Final report, July 1977—August 1978.** Ghassemi, M.; Strehier, D.; Crawford, K.; Quinlivan, S. (TRW Environmental Engineering Div., Redondo Beach, CA (USA)). Oct 1978. Contract EPA-68-02-2635. 127p. NTIS PC A07/MF A01.

The report gives results of an evaluation of the applicability of refinery control technologies to coal conversion. It is part of a comprehensive program for the environmental assessment of high-Btu gasification technology. Process/waste streams from coal gasification and liquefaction processes were characterized. Streams with refinery counterparts were identified. Toxicological and health effects data were also collected on waste stream constituents. Control technologies used in refineries to manage the identified streams were evaluated and their applicability to counterpart coal conversion streams was assessed. Study results indicate that, despite similarities between the refinery process/waste streams and their coal conversion counterparts, significant composition differences between the analogous streams would affect applicability and design of a control technology. Many refinery processes, which appear to have applicability to coal conversion process/waste streams, have not been tested for such applications. Additional testing would be necessary to generate data needed for a more accurate determination of their applicability.

48053 (PERC—0058-33) **Hot and Dry Char Letdown System for the SYNTHANE pilot plant. Phase III. Activities: brief final report.** (Lummus Co., Bloomfield, NJ (USA)). 31 Dec 1978. Contract EY-76-C-02-0058. 45p. Dep. NTIS, PC A03/MF A01.

In the SYNTHANE gasification process a carbonaceous combustible char having a heating value of 9000—10,000 Btu/lb is produced as a by-product (approximately 0.3 pound per pound of coal feed). To render the SYNTHANE process energy effective it is important that the energy available in this char be recovered since it represents a significant proportion of the available energy in the coal. The char exits the gasifier at temperatures up to 1800°F and pressures to 1000 psig. At these conditions the char contains a substantial amount of energy available as sensible heat. In the demonstration plant no attempt has been made to recover either the heating value or the sensible heat of the char. The char is simply cooled by water quench, depressurized, filtered, and disposed of as a wet filter cake. In a commercial plant means for recovering this energy must be provided. Initial planning indicated the most expedient method of heat recovery was dry depressurization of the char stream to essentially atmospheric pressure followed by combustion in a conventional boiler. To maximize the heat recovery and to assist combustion it is desirable to maintain the char temperature entering the boiler as high as possible. In June 1975, The Lummus Company was awarded a contract which provided for the design, simulation testing, and fabrication of a commercially scaleable system to discharge hot dry char from the Bruceton gasifier and theoretically be compatible with a downstream heat recovery boiler. This report covers Phase III activities for the period ending on December 31, 1978, the contract expiration date. The Phase III effort, had the contract been extended beyond the expiration date, would have required the design, fabrication and delivery of four nozzle cascade units and the required auxiliary equipment suitable for use in the SYNTHANE pilot plant. Phase III was not carried to completion because funding for the Synthane Pilot Plant was terminated.

48054 (SAN—1472-T1) **Site qualification studies of the UCG/SDB site, North Knobs, Wyoming. Chemicals and Minerals Division report No. 64RK076.** Davis, B.E.; Krajewski, S.A.; Ahner, P.F.; Avasthi, J.M.; Dolde, M.E.; Greenman, C.A.; Miranda, J.E. (Gulf Research and Development Co., Pittsburgh, PA (USA)). 23 May 1979. Contract EF-77-C-03-1472. 451p. Dep. NTIS, PC A20/MF A01.

The site qualification program for the North Knobs UCG site near Rawlins, Wyoming has been completed. This site will be the location for the field tests of Underground Coal Gasification of Steeply Dipping Beds undertaken by Gulf Research and Development Company for DOE in a cost shared contract. Site characterization included a comprehensive geotechnical analysis along with vegetation, historical, and archeological studies. The G coal seam chosen for these tests is a subbituminous B coal with a true seam thickness of 22 feet and has thin coal benches above and below the main seam. The water table is at 90 feet below the surface. Hydrologic studies have defined the seam as an aquiclude (nonaquifer). The site is deemed restorable to regulatory requirements. Evaluation of this site indicates total acceptability for the three-test program planned by GR and DC.

48055 (SAN—1472-T2) **Site qualification studies of the UCG/SDB site, North Knobs, Wyoming. Appendices.** (Gulf Research and Development Co., Pittsburgh, PA (USA)). 1979. Contract EF-77-C-03-1472. 418p. Dep. NTIS, PC A18/MF A01.

48056 (UCID—18096) **Permeability enhancement methods for preparing a coal bed for in situ coal gasification.** Hill, R.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Apr 1979. Contract W-7405-ENG-48. 29p. Dep. NTIS, PC A03/MF A01.

Seven methods of borehole linking, or permeability enhancement, are discussed; others undoubtedly could be included. A linking method should meet these requirements: (1) it must be a reliable procedure that gives good control of the subsequent gasification, and (2) it must be as inexpensive as possible. Of the methods discussed, reverse combustion combined with pneumatic or hydraulic fracturing is the most successful. However, directional drilling could become the best choice as technology improves and cost decreases.

48057 **U-gas process to produce medium- and low-Btu gas from coal.** Chicago, IL; Institute of Gas Technology (1979). 19p. (NP—23868).

The U-GAS process to produce medium- or low-Btu gas from coal has evolved from many continuous years of coal gasification R & D at IGT. Specific U-GAS work was begun about 1974 and now totals about 200,000 man-hours; costs to date total approximately $7 million and the work has produced a total of nine patent disclosures. The U-GAS pilot plant has been operational for 5 years, and is designed for a capacity of 24 tons of coal daily. Recent operations have provided data in support of the preliminary design of a commerical facility, under DOE sponsorship, that is planned for construction at Memphis, Tennessee, and would have a capacity to produce 175 x 10^6 cubic feet of medium Btu gas daily from 2800 tons of coal.

48058 **Application of the U-GAS process for the production of gas of intermediate calorific value.** Loeding, J.W.; Stanfill, I.G. Chicago, IL; Institute of Gas Technology, Chicago, IL (1979). 26p. (CONF-790512—4). Institute of Gas Technology, 3424 South State Street, IIT Center, Chicago, IL.

From 14. world gas conference; Toronto, Canada (27 May 1979).

This paper deals with the status of the Memphis (Tennessee) Light, Gas and Water Division's (MLGW) industrial fuel gas project and the recent progress in research and development activities directed at generating low- and intermediate-calorific value gas. The detailed design of a 2540 tonnes per day coal conversion demonstration plant to produce 10.76 MJ per m^3 industrial fuel gas is scheduled for completion in April of 1979. The design incorporates many proven innovative process developments available to the process designer at the time the design was made firm. The product gas, prinicpally CO and H_2, is intended for selected industrial or commercial customers as a reliable alternative to natural gas. The paper includes a status report on work underway.

48059 **Ash agglomeration in fluidized bed coal gasification.** Vora, M.K.; Sandstrom, W.A.; Rehmat, A.G. Chicago, IL; Institute of Gas Technology, Chicago, IL (1979). 8p. (CONF-790571—4). Institute of Gas Technology, 3424 South State Street, IIT Center, Chicago, IL.

From 6. national conference on energy and the environment; Pittsburgh, PA, USA (21 May 1979).

At the Institute of Gas Technology (IGT) significant work has been conducted to develop processes to utilize coal on an environmentally acceptable basis including coal conversion to low- and medium-Btu gas. The IGT U-GAS process combines a single-stage fluidized bed coal gasifier with an ash-agglomerating mechanism to achieve selective removal of high-ash-bearing material (agglomerates) and high carbon conversions. To date, successful gasification tests have been conducted with metallurgical coke breeze, bituminous coal chars, Montana subbituminous, Illinois No. 6 as well as washed and unwashed Western Kentucky No. 9 bituminous coals. Recently, U-GAS process tests have been conducted to produce design data at 60 psia (413 kPa) for an Industrial Fuel Gas Demonstration Plant.

48060 Underground coal gasification: reaction zone mapping. Curl, S.J. London, England; IEA Coal Research (1979). 71p. (ICTIS/TR—06).

This report is a review of the published literature concerning the methods of mapping the reaction zone during underground coal gasification (UCG). The reaction zone mapping methods described relate primarily to the US Department of Energy's UCG program. Mapping with temperature measurement, electrical resistivity, high frequency electromagnetic, induction, passive acoustic, induced seismic and geotechnical methods are included. The report is intended to define the state of the art of reaction zone mapping and to provide a reference document for all those interested in underground coal gasification. A comprehensive list of published reports and papers and the names and addresses of people associated with the development of reaction zone mapping methods is included.

48061 Oil from coal. Bradley, K.J. *N.Z. Energy J.;* **50**: No. 5, 72-73(25 May 1977).

Large-scale production of liquid fuels from coal has been conducted since the 1920s, initially in Germany, where fuel production by hydrogenation and Fischer-Tropsch synthesis grew to exceed five million tonnes per year by the latter stages of World War II. These plants were all closed down at the end of the war, and today, the only significant coal conversion capacity is in East Germany, which currently produces 500,000 tonnes/year of diesel fuel from lignite pyrolysis tars, and in South Africa where SASOL is adding to its Fischer-Tropsch synthesis plant at Sasolburg, capacity for 1.5 million tonnes/year motor fuels in addition to other products. However, at present there is no process available capable of commerically viable production of oil from coal in competition with natural crude, outside of the special situations existing in the above countries.

LIQUEFACTION

REFER ALSO TO CITATION(S) 48061, 48066, 48259

48062 (FE—2047-10) Clean solid and liquid fuels from coal. Quarterly progress report, July—September 1978. Gary, J.H.; Golden, J.O.; Bain, R.L.; Dickerhoof, D.W. (Colorado School of Mines, Golden (USA). Dept. of Chemical and Petroleum Refining Engineering). Nov 1978. Contract EX-76-C-01-2047. 137p. Dep. NTIS, PC A07/MF A01.

In the area of continuous coal conversion efforts were mainly devoted to data reduction and analysis of the kinetic experiments with the CSM continuous unit operating in a stirred tank reactor mode. Preliminary analysis of yield as a function of temperature and reactor residence time is presented. Modifications were made to the system to improve operation of the unit when performing experiments in a tubular reactor mode; these included moving the preheater to a vertical orientation and adding a pressurization line to the sampling system to decrease system pressure upsets during sampling. A series of seven runs were made to test this system operation. A summary of an ancillary study to investigate the effects of mineral matter, gaseous hydrogen, and residence time upon the conversion of a HVA bituminous coal is presented. In general, the results are complicated by interactions between the individual changes caused by each variable. The results do show that the conversion is affected by all of the above mentioned variables; and that investigations of mineral matter effects should continue. The major portion of the catalytic hydrodenitrogenation study was compiled. A Ni—Mo catalyst was used to perform hydrodenitrogenation experiments on a steady-state recycle oil from the Fort Lewis SRC plant. Kinetic models have been developed to represent the rate of nitrogen removal. Nitrogen removal can be modelled by either a global second order equation or by a global, parallel first-order reaction sequence. The rate of disappearance of carbazole has also been modelled as a first-order reaction. Reaction rate constants and Arrhenius activation energies for the above kinetic models are presented.

48063 Importance of coal liquefaction process to the chemical industry. Dauphine, T.C. (Badger America, Inc., Cambridge, MA). *Erdoel Kohle, Erdgas, Petrochem. Brennst.-Chem.;* **31**: No. 9, 417-420(Sep 1978).

The change in the world energy supply situation and the finite nature of essential raw materials have a remarkable influence on the future technology. New economic processes are to be developed to make available the required products. In this article the importance of coal liquefaction processes to the chemical industry is discussed. The production of liquid fuels from coal requires complex and difficult technology. Various projections permit the conclusion that adequate technology will not be available until after 1990. Till that time petroleum will remain the preferred source of both fuel and raw materials. However, unexpected events may change the course of development. The present existing coal liquefaction processes, economical questions and problems arising are discussed.

PROPERTIES

48064 (CONF-780732—6) Microstructural studies of coal and carbonaceous mixtures using differential interference-contrast microscopy. Harris, L.A.; Rouse, N.H. (Oak Ridge National Lab., TN (USA)). 1978. Contract W-7405-ENG-26. 9p. Dep. NTIS, PC A02/MF A01.

From Metallographic Society Technical conference; Montreal, Canada (16 Jul 1978).

The need for obtaining increased microstructural information from optical microscopy of coals and carbonaceous mixtures led to the present study in which the use of Differential Interference Contrast (DIC) microscopy was investigated. The three-dimensional quality conveyed to the micrographs through DIC reveals the order of hardness of the individual organic constituents. In addition, the nature of the cellular structure of semi-fusinites are more clearly identified by using DIC. Furthermore, visually observable contrast between carbonized coal fragments and semicoke formed in coal conversion systems was observable under DIC conditions, whereas in bright field conditions, these constituents are nearly indistinguishable. The results of this study suggest that DIC microscopy should be used routinely in studies of complex microstructures.

48065 (COO—0063-13) Hydrogen bonding in asphaltenes and coal. Quarterly report, January 1—March 31, 1979. Li, N.C.; Tewari, K.C.; Hara, T. (Duquesne Univ., Pittsburgh, PA (USA). Dept. of Chemistry). Apr 1979. Contract EY-76-S-02-0063. 29p. Dep. NTIS, PC A03/MF A01.

In this study, upgraded coal liquids from a blend of 30 weight percent of SRC I with 70 weight percent of SRC II, as well as from SRC II, have been studied by IR and NMR techniques. The variation of structural parameters of the upgraded liquids has been determined as a function of reaction temperature and contact time in the catalytic hydroprocessing. The results indicate that along with the decrease in heteroatom contents, asphaltene content, aromatic content and a corresponding increase in aliphatic content, the hydrogen-bonded structure and phenolic OH content of the coal liquids drastically decrease with increase in contact time and temperature. The disappearance of phenolic OH in upgrading process follows a first-order kinetics but no such dependence was observed in case of acidic NH.

48066 (FE—2035-13) Enthalpy measurement of coal-derived liquids. Quarterly technical progress report, July—September 1978. Kidnay, A.J.; Yesavage, V.F. (Colorado School of Mines, Golden (USA). Dept. of Chemical and Petroleum Refining Engineering). 1 Dec 1978. Contract EX-76-C-01-2035. 16p. Dep. NTIS, PC A02/MF A01.

Experimental measurements were completed on a naphtha sample (1046) furnished by the Pittsburgh and Midway Coal Mining Company. A total of 38 measurements were made in the temperature region 148 to 459°F, and at pressures of 100 and 300 psia. Additional analytical work was completed on the SRC-I naphtha whose enthalpy measurements were reported previously. Comparisons are given between the experimental SRC-I naphtha enthalpies and the available enthalpy data on petroleum fractions, including Kesler and Lee's correlation of these data. (LTN)

48067 (GJBX—56(79)) Uranium in coal. Facer, J.F. Jr. (Department of Energy, Grand Junction, CO (USA). Grand Junction Office). May 1979. Contract EY-76-C-13-1664. 78p. Dep. NTIS, PC A05/MF A01.

United States production of coal in 1977 was 695 million short tons of which 477 million tons were burned in power plants. The ash from these power plants was about 67 million tons containing an estimated 900 tons U_3O_8, assuming 14 percent ash from the type of coal used by utilities and 12 ppM U contained in ash. Perhaps 1 to 3 percent of the domestic uranium requirement could be met from coal ash, provided processing technology could be developed for uranium recovery at acceptable costs. However, the environmental problems for disposal of the slimy leached ash would be enormous. The average uranium grade of coal in the United States is less than half of that of the Earth's crust. Burning the coal concentrates the contained uranium in the ash from 2 to 20 times. However, even at 20 times concentration, the percent uranium in coal ash is less than 1/100 of the grade of the uranium ore being processed today from conventional deposits. Although it is conceivable that some coal ash might contain enough uranium to make the ash an economic source of uranium, this is not now the case for ash from any major coal-fired power plant in the United States. During 1963 to 67, about 180,000 tons of uranium-bearing carbonaceous rock from the southwestern part of the Williston Basin were mined and processed to recover about 1 million pounds of U_3O_8. None of this material has been mined since 1967. The uranium reserves of the area are small, and the environmental problems with calcining the lignitic material may be prohibitive. Some other uraniferous coal and lignite could be mined and processed as a uranium ore, but less than half of one percent of the domestic $30 reserves are in coal. A few samples of

mid-continent coal have been reported to contain about 100 ppM U but little is known about the size of such deposits or the likelihood that they will be mined and used for power plant fuel to produce a high-uranium ash.

48068 (ORNL/MIT—278) **Surface properties of alkali-treated Wyodak coal.** Dillon, J.J.; Talbert, C.M.; Zimmer, M.F. (Oak Ridge National Lab., TN (USA)). 25 Sep 1978. Contract W-7405-ENG-26. 25p. Dep. NTIS, PC A02/MF A01.

The surface properties of alkali-treated Wyodak coal were studied using gravimetric, mass spectrometric, and calorimetric techniques. The results were compared with a similar study of untreated Wyodak coal. The treatment increased water sorption and the heat of immersion in water and decreased N_2 and CO_2 sorption. Both treated and untreated coal evolved CO_2 and H_2O on outgassing with only the rate of CO_2 evolution dependent on temperature. Unlike the untreated coal, the treated coal formed a colloidal suspension in water. These findings are explained in terms of a flexible coal structure and treatment-induced polarity of the coal surface.

WASTE MANAGEMENT

REFER ALSO TO CITATION(S) 48050, 48067, 48538, 48956

48069 (BM-IC—8806) **Citrate process demonstration plant design.** Nissen, W.I.; Madenburg, R.S. (Bureau of Mines, Salt Lake City, UT (USA). Salt Lake City Metallurgy Research Center). 1979. 18p. Bureau of Mines, Washington, DC.

This Bureau of Mines report presents the design for a commerical-sized flue gas desulfurization (FGD) demonstration plant that uses the citrate process. The goal of the Bureau's citrate process is to minimize the undesirable environmental impacts of industrial plants emitting SO_2-bearing gas. The FGD plant is located at the George F. Weaton powerplant, Monaca, Pa. Construction was completed in April 1979 and will be followed by preliminary testing and a 1-year testing and evaluation program. Design capacity of the FGD plant is 156,000 scfm of 0.2-volume-percent-SO_2 flue gas yielding abut 16 tons of sulfer per day. The plant is intended to (1) clean fly ash, SO_3, and Cl^- from the gas while cooling the gas in a venturi scurbber, (2) absorb SO_2 from the gas using 1,200 gpm of a cuntercurrent-flowing citric acid-sodium citrate-sodium thiosulfate solution, (3) react the absorbed SO_2 in two 13,000-gal stirred closed vessels with added H_2S, thus precipitating elemental sulfur and regenerating the citrate solution for recycle, and (4) recover the sulfur from the slurry by air flotation, followed by melting in a heat exchanger and separation from the occluded citrate solution in a sulfur decanter at 35 psi and 135° C.

48070 (CONF-790477—1) **Use of oil shale for SO_2 emission control in atmospheric-pressure fluidized-bed coal combustors.** Wilson, W.I.; Snyder, R.B.; Johnson, I. (Argonne National Lab., IL (USA)). 1979. Contract W-31-109-ENG-38. 19p. Dep. NTIS, PC A02/MF A01.

From Annual meeting of national organization for the professional advancement of black chemists and chemical engineers; Houston, TX, USA (18 Apr 1979).

Oil shale—SO_2 reactivity, determined with a thermogravimetric analyzer, was used to estimate the quantity of oil shale required to reduce SO_2 concentration in the effluent gas sufficiently to meet the SO_2 emission standard in atmospheric-pressure fluidized-bed coal combustion (AFBC). It was calculated that the oil shale could reduce the SO_2 concentration in the effluent gas from FBC units below the SO_2 emission limit. In evaluating virgin oil shale and spent oil shale for SO_2 emission control, we compared them with (1) Germany Valley limestone, (2) Greer limestone, and (3) Tymochtee dolomite. The results indicate that, due to the low calcium content of the shale, less dolomite or limestone than oil shale, may be required to meet the SO_2 emission standard. The attrition rate of Green River oil shale was found to be similar to attrition rates of limestones and dolomites.

48071 (LA-UR—79-1674) **Disposal and reclamation of southwestern coal and uranium wastes.** Wewerka, E.M. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 17p. (CONF-790550—2). Dep. NTIS, PC A02/MF A01.

From Energy and environmental technology training conference; Tsaile, AZ, USA (29 May 1979).

The types of solid wastes and effluents produced by the southwestern coal and uranium mining and milling industries are considered, and the current methods for the disposal and reclamation of these materials discussed. The major means of disposing of the solid wastes from both industries is by land fill or in some instances ponding. Sludges or aqueous wastes are normally discharged into settling and evaporative ponds. Basic reclamation measures for nearly all coal and uranium waste disposal sites include solids stabilization, compacting, grading, soil preparation, and revegetation. Impermeable liners and caps are beginning to be applied to disposal sites for some of the more harmful coal and uranium waste materials.

48072 **Flow regimes of downhole flow of a gas—parricle mixture.** Stokes, V.K. (Foster-Miller Associates, Inc., Waltham, MA). *J. Fluids Eng.;* **100**: No. 4, 410-413(Dec 1978).

Assuming that a gas—particle mixture behaves like a homogeneous gas, in which the slip velocity of the particles is negligible, the various flow regimes in one-dimensional downhole flow, including the effects of gravity, compressibility and wall friction, have been investigated. It is assumed that the flow is isothermal and that the wall shear can be accounted for by an empirically determined friction factor.

48073 **Chemistry and biological hazard of a coal ash seepage stream.** Coutant, C.C.; Wasserman, C.S.; Chung, M.S.; Rubin, D.B.; Manning, M. (Oak Ridge National Lab., TN). *J. Water Pollut. Control Fed.;* **50**: 747-753(Apr 1978).

Despite careful control and monitoring of overflows from coal ash settling ponds, a significant potential exists for environmental impacts from uncontrolled seepage of rainwater and slurry water through ash deposits and containment dikes. This potential has been demonstrated through an analysis of seepages, now controlled, from the Tennessee Valley Authority's Bull Run Steam Plant on the Clinch River near Oak Ridge, Tenn. Acidic, iron-rich seepage water is produced within the ash deposits through physical and microbiological (presumably) processes. These seepage conditions also may mobilize other contaminants. An iron floc, which results when the acidic seepage enters the slightly alkaline river water, is detrimental to fish and bottom organisms in the vicinity. The particular flow problem addressed in this report may not occur at all coal-fired power plants with ash-settling ponds. However, the case for careful design and proper maintenance for disposal of this solid waste has been demonstrated.

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 48048, 48052, 48054, 48055, 48071, 48073, 48097, 49103, 49114, 49118, 49120, 49130, 49135, 49153

48074 (CONF-790625—6) **Mutagenicity testing of extracts from petroleum and coal tar pitches.** Rao, T.K.; Epler, J.L.; Eatherly, W.P. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 2p. Dep. NTIS, PC A02/MF A01.

From 14. carbon conference; University Park, PA, USA (25 Jun 1979).

Dimethylsulfoxide extracts of Ashland-240 petroleum pitch and Barrett M-30 coal tar pitch were tested for mutagenicity using Salmonella histidine reversion assay (Ames test). Four strains of Salmonella were employed. The strains sensitive to frameshift mutations were reverted, with the coal tar pitch indicating a three fold greater mutagenic activity than the petroleum pitch. Metabolic activation with rat liver extracts was required. As a prescreen to aid investigators in ordering their priorities, the short-term tests appear to be a valid approach to testing the large number of hazardous compounds and complex mixtures that man encounters in his environment.

48075 (CONF-790737—2) **Reclamation of abandones mine lands and fish and wildlife mitigation needs.** Haynes, R.J.; Klopatek, J.M. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 20p. Dep. NTIS, PC A02/MF A01.

From Mitigation symposium; Ft Collins, CO, USA (17 Jul 1979).

The Surface Mining Control and Reclamation Act of 1977 has provided a funded program for reclaiming the nation's abandoned coal-mine lands. This paper reviews methods of inventorying such lands and discusses criteria and planning strategies needed to ensure that fish and wildlife values are given consideration in development and implementation of reclamation plans. Habitat evaluation methods are briefly discussed.

48076 **Environmental issues in coal use--a future perspective.** Greenway, A.R.; Rogers, J.A. (Fred C. Hart Assoc, Inc, New York, NY). *Proc. Air Pollut. Control Assoc.;* **1**: 1-16(1978).

The study of Environmental Issues in Future Coal Use performed for ERDA (now DOE) that had as its objective to identify environmental constraints that should be considered in the planning for inexhaustible versus exhaustible energy resource development is described. The study was conducted over a short time period, used broad assumptions and generalizations and was based on readily available data and reports. 15 refs.

MINING

REFER ALSO TO CITATION(S) 48072, 48075

48077 (ACIRL-PR—77-13) **Study of coal mining research in overseas countries.** Richards, O.J. (Australian Coal Industry Research Labs. Ltd., Sydney). Aug 1977. 96p. Australian Coal Industry Research Labs. Ltd., Sydney.

This report discusses coal industry research in Poland, the Federal Republic of Germany, France, the United Kingdom, the USA and Canada. The research work covered includes: improvement in percentage recovery of coal (thick seam mining and single entry development); new methods for roadway support; identification and measurement of rock characteristics; methane drainage; outbursts; detection and control of spontaneous combustion; seismic techniques; and automation of mining equipment.

48078 (CONF-780886—, pp 33.1-33.15) **Overview of the Department of Energy's program on the development of automated machinery for underground mining.** Fisher, T.J.; Palowitch, E.R. 1 Oct 1978.

From 4. WVU conference on coal mine electrotechnology; Morgantown, WV, USA (2 Aug 1978).

The Department of Energy's mining research program is directed toward the improvement of current mining systems and the development of new mining systems which will ensure adequate supplies of coal at acceptable costs. More specifically, tomorrow's coal mining industry must meet the following minimum requirements: it must guarantee the health and safety of the worker; it must minimize adverse environmental impacts; it must maximize recovery of coal resources; and it must remain competitive with other energy sources. Control systems for longwall shearers, possibly using remote sensing devices to determine seam and roof or floor interface, are described. Similarly automated roof bolting machines are under development for room and pillar mining. Combined miner/bolter and bolter-transfer machines are discussed. The feasibility of remote supervisory control is also being investigated. A continuous mine haulage system is discussed briefly. (LTN)

48079 (CONF-780886—, pp 34.1-34.11) **Coal interface sensors for automated mining machines.** Pazuchanics, M.J.; Palowitch, E.R. 1 Oct 1978.

From 4. WVU conference on coal mine electrotechnology; Morgantown, WV, USA (2 Aug 1978).

There are several underground and surface coal extraction machines which could be highly automated if adequate sensors were available. The primary sensors required to keep automated mining machines working within the coal seam are coal interface detectors (CID). A brief review of the Department of Energy's (DOE) efforts to develop both depth measuring and surface recognition coal sensors is presented. The discussion highlights work on nucleonic, EM radar, and machine vibration type detectors.

48080 (FE—9041-1) **Investigations of differential strata movements and water table fluctuations during longwall operations at the Somerset Mine No. 60. Final technical report as of 15 October 1978.** Barla, G.B.; Boshkov, S. (Columbia Univ., New York (USA)). Nov 1978. Contract ET-76-C-01-9041. 149p. Dep. NTIS, PC A07/MF A01.

This research work was directed toward the acquisition of data describing the phenomenology of failure of superincumbent strata during longwall mining operations in the Pittsburgh coal seam. The specific site for the study was the second panel in the Somerset Mine No. 60, belonging to the Bethlehem Steel Company, and located near Washington, Pennsylvania. The thickness of the coal approximated 68 inches. Two boreholes were instrumented as strata movement monitoring stations, drilled from the surface to the coal seam, which was located under 330 feet to 430 feet of cover. Five additional holes were drilled to an approximate depth of 150 feet in order to permit observations on the water table fluctuations. Cores recovered from the two instrumented boreholes were geomechanically logged throughout. The recorded data indicate that strata behavior differs in locations close to the first break from those which follow the establishment of regular caving. The fracture of impermeable layers inevitably leads to sudden drops in the water table. The data suggest the existence of a very steep angle of fracture growth coupled to an immediate propagation upward for the caved area.

48081 (HCP/T8915—01(5)) **Analysis of US underground thin seam mining potential. Volume 1. Text. Final technical report, December 1978.** Pimental, R.A; Barell, D.; Fine, R.J.; Douglas, W.J. (Ketron, Inc., Wayne, PA (USA)). Jun 1979. Contract ET-77-C-01-8915. 89p. Dep. NTIS, PC A05/MF A01.

An analysis of the potential for US underground thin seam (< 28") coal mining is undertaken to provide basic information for use in making a decision on further thin seam mining equipment development. The characteristics of the present low seam mines and their mining methods are determined, in order to establish baseline data against which changes in mine characteristics can be monitored as a function of time. A detailed data base of thin seam coal resources is developed through a quantitative and qualitative analysis at the bed, county and state level. By establishing present and future coal demand and relating demand to production and resources, the market for thin seam coal has been identified. No thin seam coal demand of significance is forecast before the year 2000. Current uncertainty as to coal's future does not permit market forecasts beyond the year 2000 with a sufficient level of reliability.

48082 (HCP/T8915—01(Vol.2)(App.)) **Analysis of US underground thin seam mining potential. Volume II. Apendices. Final technical report, December 1978.** Pimentel, R.A.; Barell, D.; Fine, R.J.; Douglas, W.J. (Ketron, Inc., Wayne, PA (USA)). Jun 1979. Contract ET-77-C-01-8915. 47p. Dep. NTIS, PC A03/MF A01.

48083 (HCP/T8915—01(Vol.3)) **Analysis of U.S. underground thin seam mining potential. Volume III: data base. Final technical report.** Pimental, R.A.; Barell, D.; Fine, R.J.; Douglas, W.J. (Ketron, Inc., Wayne, PA (USA)). Dec 1978. Contract ET-77-C-01-8915. 199p. Dep. NTIS, PC A09/MF A01.

48084 (HCP/T9101—01) **Evaluation of foam concrete for a rapid centerwall placement system. Final technical report, September 1978.** (MSA Research Corp., Evans City, PA (USA)). Jun 1979. Contract ET-75-C-01-9101. 68p. Dep. NTIS, PC A04/MF A01.

A system has been developed and demonstrated that is capable of placing a foamed concrete centerwall behind a DOSCO inseam heading machine at a rate of 45 feet per shift. The DOSCO unit is being studied by the Bureau in a Single Entry Mine Development concept to decrease the time of new mine development. The function of the centerwall is to provide ventilation, an escapeway and roof support as the DOSCO unit advances. The centerwall system is based on the production of about 40 pcf cellular concrete in an existing foam concrete unit, and its placement in a newly-developed rapid advance forming system. The forming system consists of reusable steel panels, 9 feet in length, that can be easily ganged together for pours of the required length. The panel design, joining technique, and tie assemblies use standard commercial concrete forming techniques; the in-mine features, however, are unique. The system employs a suspended traveler rail and carrier to move the individual panels to the advance pour site. The traveler rails use in-place roof bolts for suspension. A complete system would be based on the pneumatic conveying of the cement from a bulk supply source to the point of use, using equipment now employed for the bulk handling of rockdust. Other applications are considered briefly.

48085 (PB—288497) **Source assessment: open mining of coal. State of the art. Final report, September 1974—September 1977.** Rusek, S.J.; Archer, S.R.; Wachter, R.A.; Blackwood, T.R. (Monsanto Research Corp., Dayton, OH (USA)). Sep 1978. Contract EPA-68-02-1874. 90p. NTIS PC A05/MF A01.

This report describes a study of atmospheric emissions from the open mining of coal. The potential environmental effect of this emission source was evaluated using source severity, defined as the ratio of the maximum ground-level concentration of a pollutant at a representative plant boundary to a hazard factor. The hazard factor is the ambient air quality standard for criteria pollutants and an adjusted threshold limit value for other pollutants. Respirable dusts are generated from five unit operations and from wind erosion.

48086 **Measurement of methane concentration by the CTT 63/40 U system.** Piela, J. *Mech. Autom. Gorn.;* **25**: No. 9, 15-21(Sep 1977). (In Polish).

The CTT 63/40 U telemetric methane monitoring system is described, and its advantages and disadvantages are discussed on the basis of experience in Polish mines.

48087 (WAESD-TME—2940) **First phase of a coalbed methane extraction and utilization program.** (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.). Apr 1979. Contract EW-78-C-21-8332. 115p. Dep. NTIS, PC A06/MF A01.

The site on which the project is being conducted is an 850 acre tract of land owned by Westinghouse Electric Corporation in Westmoreland County, Pennsylvania. In the first phase, the objective is to establish the credibility of the site as a fuel reservoir. For this to be accomplished, it is necessary that a well be drilled, the coal seams stimulated, the gas content of the coal and flow rate determined, and the well connected to the existing gas pipeline system at the local Westinghouse plant. The first phase of the project was started in May 1978, drilling of the production well was started in September 1978 and the well was placed on line delivering gas to the Westinghouse plant in April 1979. The production well was drilled to a total depth of 767 feet through 12 coal seams having a total thickness of about 27 feet. The methane produced was of very high quality, being about 99.2% pure methane. Core samples indicated the gas content is not as high as had been anticipated. Nevertheless, flow rates in excess of 50 mcf/day have been measured with the well in

the free flowing condition. Actual gas production is expected to be less than that depending on the needs of the Westinghouse plant on site. Methane is being delivered to the existing gas pipeline system on site via a gas processing station which filters particulate matter, separates out moisture, monitors the flow and regulates the gas pressure to the pipeline. An economic analysis of a projected six well system shows that the system will pay for itself in five years, earn a 15% return on the investment, and, in addition, provide a cash income exceeding $29,000/year over the projected twelve year life of the system. An Environmental Impact Assessment was completed. Temporary disturbances of a minor nature will occur during construction.

48088 Underground mine communications. Murphy, J.N.; Parkinson, H.E. (Bureau of Mines, Pittsburgh, PA). *Proc. IEEE ;* **66**: No. 1, 26-50(Jan 1978).

Underground mines are, typically, extensive labyrinths that employ many people working over an area of many square miles; extensive analysis of mine-communications systems has identified specific problem areas, in particular the excessive times required to locate key personnel underground, the inadequacy of existing phone systems in terms of capacity and privacy, and the inability to communicate with men on the move with wireless communications, as is taken for granted on the surface. A review is presented of the existing systems, the problem definition, and the various approaches that have been or are being investigated to solve these problems.

48089 Review of the contribution made by powered roof supports . Whittaker, B.N. *Nottingham Univ. Min. Dep. Mag.;* **28**: 21-33(1976).

Paper traces the main changes which have occurred in longwall face supports, and reviews the basic principles of strata loading of face supports. Comments are made on present-day designs of powered roof supports, especially in respect of improved working conditions and extending the scope of mechanized longwall mining.

TRANSPORT AND HANDLING

REFER ALSO TO CITATION(S) 48051, 48791, 48793, 48794

48090 Review of design equations for dilute phase gas-solids horizontal conveying systems for coal and related materials. Arastoopour, H.; Modi, M.V.; Punwani, D.V.; Talwalkar, A.T. Chicago, IL; Institute of Gas Technology, Chicago, IL (1979). 18p. (CONF-790559—2). Institute of Gas Technology, 3424 South State Street, IIT Center, Chicago, IL.

From Powder and bulk solids conference and exhibition; Philadelphia, PA, USA (15 May 1979).

Ever increasing importance of coal in solving energy problems increases the need for reliable equations for design of coal conveying systems. The Institute of Gas Technology (IGT) has a contract with the US Department of Energy to prepare a coal conversion systems technical data book. As part of this program, IGT has reviewed the available design methods for dilute-phase gas-solids horizontal conveying systems for materials like coal and char used in coal conversion processes. The published data are used to evaluate the available correlations for estimating saltation velocity and pressure drop in horizontal conveying lines. The correlations, original or modified, that best predict the data are recommended. In all a total of 18 correlations were evaluated with respect to 7 sets of data points covering wide ranges of operating conditions including solids leading of 0.3 to 22 lb of solids/lb of gas, pipe diameters of 1 to 12 inches, particle sizes of 100 to 25000 micron and particle densities of 10 to 540 lb/ft^3.

COMBUSTION

REFER ALSO TO CITATION(S) 48529, 48791, 48792, 48793, 48794, 48795, 48796, 48797, 48798, 48799, 48930

48091 (ANL/CEN/FE—79-3) **Support studies in fluidized-bed combustion. Quarterly report, October—December 1978.** Johnson, I.; Swift, W.M.; Lee, S.H.D.; Shearer, J.A.; Teats, F.G.; Turner, C.B.; Wilson, W.I.; Jonke, A.A. (Argonne National Lab., IL (USA)). May 1979. Contract W-31-109-ENG-38. 53p. Dep. NTIS, PC A04/MF A01.

These studies support the development program in atmospheric and pressurized fluidized-bed coal combustion. Laboratory and process development-scale studies are aimed at providing information on limestone utilization, control of the emission of alkali metal compounds and SO_2 during combustion, particulate loading in flue gas, and other aspects of fluidized-bed coal combustion. This report presents information on the effect of bed temperature, superficial gas velocity and gas hourly space velocity on the removal of gaseous NaCl from hot gas streams by a granular bed of diatomaceous earth; results of experiments in which the adsorption capacity for gaseous NaCl of activated bauxite was measured after regeneration by an aqueous leaching process; and an estimate of the cost of using these two sorbents for alkali metal control in a large PFBC. Results are also presented for studies aimed at the development of an acoustic dust conditioning system, and the evaluation of a high-efficiency cylone for removal of particles from a high-pressure, high-temperature gas stream. The relationship of the SO_2 reactivity of limestones to internal surface area, pore diameter, and pore volume are examined.

48092 (COO—4740-4) **Operation, modification, and maintenance of DOE/PETC 700 H.P. Combustion Test Facility. Quarterly activity report, January 1, 1979—April 1, 1979.** (Management and Technical Services Co., Clairton, PA (USA)). 1979. Contract EW-78-C-02-4740. 7p. Dep. NTIS, PC A02/MF A01.

Number six fuel oil tests, 30% COM tests, and 40% COM tests were conducted. Operation, modification, and maintenance of the combustion test facility is described. (LTN)

48093 (COO—4740-5) **Operation, modification, and maintenance of DOE/PETC 700 H.P. combustion test facility. Yearly activity report, April 3, 1978—April 1, 1979.** (Management and Technical Services Co., Clairton, PA (USA)). 1978. Contract EW-78-C-02-4740. 20p. Dep. NTIS, PC A02/MF A01.

The operation, modifications and maintenance of the DOE/PETC 700 H.P. combustion test facility are described. Shakedown and operation limit tests were performed with No. 6 fuel oil and 30% COM. The tests involved flame studies, erosion, corrosion and the examination of boiler deposits. Various construction, modification and maintenance efforts are detailed. The original 100 H.P. test facility was scrapped after 3 months operation under this contract and construction of a new 100-20 H.P. test facility begun. (LTN)

48094 (DOE/ERD—0023) **Environmental readiness document: coal/oil mixtures.** (Department of Energy, Washington, DC (USA)). Jun 1979. 29p. Dep. NTIS, PC A03/MF A01.

The risks to successful commercialization of COM from environmental concerns fall into two categories: first, that significant environmental or health impacts that had not been anticipated will be identified and, second, that the magnitude of actual impacts will be considerably larger than anticipated and wll not be readily mitigated or acceptably controlled using existing environmental control technology. As COM technology is quite similar to conventional combustion in terms of environmental effects, these risks appear low. The status of environmental laws and regulations that may affect the use of COM is outlined. The concerns identified include both known environmental concerns and areas where a strong potential exists for the identification of environmental concerns. The status of regulations and standards under the major environmental laws, which pollutants are of concern, and possible future revisions to the standards are discussed. The major areas of environmental concern associated with the use of COM are the ability to control particulate and sulfur oxide emissions, the possibility of adverse toxic pollutant emissions due to the use of additives, emissions of soot due to boiler derating, the disposal of solid and liquid wastes, and health impacts in urban areas. Each concern is discussed in detail. The environmental risks of proceeding with commercialization of COM relative to these concerns are outlined. COM will be retrofit to existing utility and industrial boilers. EPA has ruled that facilities that switch from oil to COM would remain classified as existing facilities and would therefore not be bound by New Source Performance Standards.

48095 (FE—2744-T1) **Combustion of methanol coal slurries in the Hartmann resonator. Final report, August 15, 1977—March 15, 1979.** Kranc, S.C. (University of South Florida, Tampa (USA). Coll. of Engineering). Mar 1979. Contract EF-77-G-01-2744. 31p. Dep. NTIS, PC A03/MF A01.

A series of experiments were conducted to determine the combustion characteristics of mixtures of finely pulverized coal suspended in methanol. Such mixtures could be attractive alternate fuels since the advantages of methanol combustion are retained while raising the heating value on a mass basis. A second major aspect of this study was concerned with the development and application of the Hartmann atomizer to deliver the fuel. This is an air atomizer which produces intense gas pulsations that help to disrupt and disperse the fuel. Fuel mixtures using several coal types were tested. The fuels were burned in the wake of a disk baffle incorporating the atomizer and located in a water jacketed flame tube. Measurements of heat deposited in the water jacket and exhaust gas were made. Analysis of the data indicates that the coal suspensions compare favorably to pure methanol under test conditions.

48096 (NYU/DAS—79-02) **Bed expansion and heat transfer measurement in a pressurized fluidized bed.** Zakkay, V.; Miller, G.; Rosen, S.; Shah, S.; Kolar, A.K. (New York Univ., NY (USA). Div. of Applied Science). Apr 1979. Contract EX-76-S-01-2317. 26p. (CONF-790423—14). Dep. NTIS, PC A03/MF A01.

From 2. multiphase flow and heat transfer symposium workshop; Miami Beach, FL, USA (16 Apr 1979).

The feasibility of utilizing pressurized bed coal combustion for the generation of electricity is presently being considered by several industrial organizations. At present, only atmospheric units of large scale are available, and little is known with respect to the effect of pressure on the flow characteristics within the bed. It is for this reason that the research at NYU is directed to the basic understanding of the fluid mechanics within a pressurized bed specifically with regard to maximizing heat transfer. In the present paper, detailed in-bed pressure and heat transfer measurements within a one-foot diameter bed are presented in order to deduce the effects of superficial velocity, bed pressure, and bed depth on an important parameter affecting the entire flow field, the expanded height of the bed.

48097 **Trace elements from coal combustion: atmospheric emissions.** Lim, M.Y. London, England; IEA Coal Research (1979). 58p. (ICTIS/TR—05).

This is a review of the literature relating to trace elements in coal combustion. Some data on trace element concentration in coal is presented. Trace element behavior and their emission from coal combustion is studied from the point of view of atmospheric pollution. Comparisons are also made with atmospheric emissions from other sources. Environmental effects and potential health hazards are discussed. The literature on radioactive emissions and trace element accumulation around power plants is also reviewed. A brief summary is given of types of equipment used for particulate control in power plants. The importance of coal combustion as a polluter will depend upon the establishment of regulations for emission control and on how far power plants comply with these regulations.

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 48771

48098 (DOE/EIA—0184/8) **Demand for world coal through 1995. Analysis report.** Weigel, H.S. (Department of Energy, Washington, DC (USA). Energy Information Administration). May 1979. 36p. Dep. NTIS, PC A03/MF A01.

The analysis is based on the results of several energy models of the Energy Information Administration (EIA). Results from the International Energy Evaluation System (IEES) constituted the most significant contribution. The U.S. forecasts were obtained from the Midterm Energy Market Model (MEMM) reports. The modeling framework within which the analysis was made is that used for the projections made for the 1978 EIA Annual Report to Congress (ARC). The assumed world oil price levels were estimated by EIA in a related study using the Oil Market Simulation (OMS) model. The principal results are as follows: The non-CPE World coal (including lignite) consumption is projected to steadily increase from 1400 million metric tons in 1976 to 2700 to 3200 in 1995. Steam coal trade is expected to increase significantly. An increasng proportion of coal fired electricity generation is also expected. The results depend on economic growth assumptions, world oil price assumptions, and calculated fuel switching, as well as an assumed increase in nuclear power. (LTN)

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 48086, 48088, 48772, 49129

REGULATIONS

REFER ALSO TO CITATION(S) 48075

PETROLEUM

GEOLOGY AND EXPLORATION

REFER ALSO TO CITATION(S) 49087

48099 (BETC—1812-1) **Evaluation of heavy-oil potential of northeastern Craig and northwestern Ottawa Counties, Oklahoma.** Harrison, W.E.; Roberts, J.F.; Heath, L.J. (Oklahoma Geological Survey, Norman (USA)). Jun 1979. Contract ET-78-S-03-1812. 56p. Dep. NTIS, PC A04/MF A01.

This project was undertaken to evaluate the heavy-oil (oil less than 25° API) potential of northeastern Oklahoma - specifically, northwestern Ottawa and northeastern Craig Counties, the area considered to have the best possibility for shallow, heavy-oil accumulations. Although previous reports indicated that potential resources of the entire region possibly amounted to billions of barrels of oil in place, a detailed subsurface investigation of the Oklahoma study area, including an 18-hole drilling and coring program, has shown that insignificant quantities of heavy oil are present in discontinuous Middle Pennsylvanian sandstones of varying permeability. 2 tables, 9 figures.

DRILLING AND PRODUCTION

REFER ALSO TO CITATION(S) 48150, 48963, 48999

48100 (BETC—79/2) **Contracts and grants for cooperative research on enhanced oil and gas recovery and improved drilling technology. Progress review No. 18, quarter ending March 31, 1979.** Linville, B. (ed.). (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). Jun 1979. 129p. Dep. NTIS, PC A07/MF A01.

The contracts and grants are listed under: chemical flooding - field projects and supporting research; carbon dioxide - field projects and supporting research; thermal/heavy oil - field projects and supporting research; western gas - field projects and supporting research; improved drilling technology; general supporting research; residual petroleum; environmental; and petroleum technology. (LK)

48101 (CONF-790541—23) **Solar enhanced oil recovery.** Mills, J.I. (Idaho National Engineering Lab., Idaho Falls (USA)). 1979. Contract EY-76-C-07-1570. 5p. Dep. NTIS, PC A02/MF A01.

From International Solar Energy Society meeting; Atlanta, GA, USA (28 May 1979).

Portions of document are illegible.

This paper discusses the utilization of currently available solar energy steam production technologies in the steam drive enhanced oil recovery process. Substitution of solar energy could lead to an increase, by the amount of the substitution, of the total crude oil reserves amenable to recovery using steam drive techniques. In addition, the substitution of currently available solar technologies in the steam drive process would result in an extension of the economic limit appropriate to enhanced oil recovery and a subsequent increase of the number of economically attractive candidate reservoirs. In the current paper, a model solar steam drive thermal system is assumed and sized for a specific thermal load. The total capital cost of the solar system is developed and compared to the total costs of existing fossil-fuel fired steam generating systems of comparable capacity.

48102 (DOE/IA—0007) **1985 oil production of 21 oil producing non-OPEC countries.** Warner, A.J. (Department of Energy, Washington, DC (USA)). Mar 1979. 105p. Dep. NTIS, PC A06/MF A01.

This report assesses the possibility of increased oil production from 21 less developed non-OPEC countries (excluding the Middle East and Mexico) by 1985. The forecast is compared with those prepared by the World Bank, the International Energy Agency, and others. The 21 Latin American, African, and Far East (including Asia) countries produce 2.5 million barrels of oil per day (BD) or 4.2% of world production, and they have 21 billion barrels of proved reserves, or 3.2% of the world total. In recent years these countries have consumed 3.1 million BD, some 0.9 million barrels in excess of their production. By 1985, the 21 countries may produce 3.9 million BD, an average annual increase of 5.0%; however, demand is expected to increase at an annual rate of 3.5% to 4.4 million BD. The net effect is that the 1985 aggregated supply-demand balance will be in deficit, by nearly 560 thousand BD, compared to slightly more than 930 thousand BD in 1976.

48103 (DOE/RA—0037) **Federal leasing and outer continental shelf energy production goals.** (Department of Energy. Washington, DC (USA). Office of Leasing Policy Development). Jun 1979. 427p. Dep. NTIS, PC A19/MF A01.

The goals are determined by adding the production from existing OCS leases, estimated production from lease sales appearing on DOI's draft proposed lease schedule for 1979—81 and on DOE's schedule for the 1982—February 1985 period. DOE's average production goals can be stated in terms of current total OCS production and current total domestic production of oil and natural gas. As a percent of estimated 1978 OCS production, the average goals are 97% for oil and 86% for gas in 1985, 204% for oil and 76% for gas in 1990, and 199% for oil and 45% for gas in 1995. Expressed as a percent of 1978 domestic production, the average goals amount to 9% for oil and 19% for gas in 1985, 20% for oil and 17% for gas in 1990 and 19% for oil and 10% for gas in 1995. The average oil production goals increase while the average gas production goals decrease from 1985 to 1990. From 1990 to 1995, there is a slight decrease in the average oil goal and a substantial decrease in the average gas goal. Reducing the maximum number of sales per year from seven to six results in 4% less total oil production and 15% less

total gas production. This compares to 3% more total oil production and 2% more total gas production with eight sales per year. Compared to DOE's seven sales per year schedule for 1982—February 1985, DOI's draft proposed lease schedule for this same period provides 58% of the total oil production and 72% of the total gas production. This is a difference of 904 mmbbl of oil and 1459 bcf of gas production over the production life of the leases.

48104 (SAND—79-0787) **Solar enhanced oil recovery; an assessment of economic feasibility.** Bergeron, K.D. (Sandia Labs., Albuquerque, NM (USA)). May 1979. Contract EY-76-C-04-0789. 56p. Dep. NTIS, PC A04/MF A01.

There are several qualitative reasons why steam injection enhanced oil recovery (EOR) appears to be well suited to solar energy. These include favorable characteristics with regard to energy utilization, land availability, energy form, and geographical location. A number of technical questions require further research before the characteristics of solar enhanced oil recovery (SEOR) can be precisely specified or optimum systems designed. However, a cost model based on a number of working assumptions indicates competitiveness with conventional fuel burning EOR systems at crude prices and solar collector system costs which can reasonably be expected to occur in the near future.

48105 (SAND—79-1023) **Potential of downhole steam generation to the recovery of heavy oils.** Bader, B.E.; Fox, R.L.; Stosur, J.J. (Sandia Labs., Albuquerque, NM (USA); Department of Energy, Washington, DC (USA)). 1979. Contract EY-76-C-04-0789. 27p. (CONF-790649—1). Dep. NTIS, PC A03/MF A01.

From 1. international conference on the future of heavy crude and tar sands; Edmonton, Canada (4 Jun 1979).

Downhole steam generation offers exceptionally high overall thermal efficiency. Numerical simulation of the downhole steam generation process combined with the effect of noncondensable gases indicates a synergistic effect, the result of which is the recovery of oil in approximately two-thirds of the time compared to oil recovery from steam drive. Downhole steam generation may overcome air pollution problems - a major constraint in wider application of steam for heavy oil recovery. In fact the liability of combustion products in surface steam generation may be an asset in a downhole steam generation configuration. Pollutants other than CO_2 are either trapped in residual fluids within the reservoir or may be produced and separated conveniently from the produced liquids. Economic benefits of downhole steam generation are such that the operating cost per barrel of produced oil is approximately independent of depth to about 5000 ft and are comparable to the present cost of oil recovery in commercial operations using surface steam generation. Major problems which need to be solved are: high pressure combustion problem, material and design problems associated with high temperature and corrosive environment, high pressure and temperature packers, and the development of a reliable system for the remote control of the air/fuel ratio.

48106 Method and apparatus for nuclear heating of oil-bearing formations. Alspaw, D.I. US Patent 4,416,095. 27 Mar 1979. Filed date 15 Jul 1977. 8p.

A method and apparatus are provided for using heat generated by absorption of radiation from nuclear waste materials to reduce the viscosity of petroleum products contained within a subsurface earth formation. The nuclear waste material is positioned in a salt water formation underlying the subsurface earth formation so that the radiation emitted by the material heats the salt water formation. conduction and convection transfer the heat to the subsurface earth formation, raising the temperature and thereby reducing the viscosity of the petroleum products. To prevent radioactive contamination within the salt water formation, the nuclear waste material may be encapsulated in a material selected to absorb alpha and beta radiation.

48107 Changes in the production cost of oil recovery as a function of water flooding economics of forced recovery. Shchelkaev, V.N. *Neft. Khoz.;* No. 1, 7-11(1979). (In Russian).

A simple relationship between production cost and the degree of waterflooding was established on the basis of petroleum production costs in the USSR and the USA. This formula and the parameters computed by it make it possible to estimate the effect that the increase in the fluid yield of a flooded oil well has on the recovery costs. This is very important for the economics of forced recovery. 4 tables, 3 references

48108 Outer continental shelf statistics: oil, gas, sulfur, salt, leasing, drilling, production, income. Calendar year 1978, 1953—1978. Harris, W.M.; McFarlane, B.E.; Piper, S.K.; Arritt, D.J. (comps.). Reston, VA; Geological Survey (1979). 106p. (NP—23865).

Information and data are provided on geological and geophysical exploration, leasing, development, production, and revenue for the US outer continental shelf. Related maps of Alaska, the Atlantic seacoast, Gulf of Mexico, Texas coast, Louisiana coastal area, and the Pacific coast are provided. Statistics by years (mostly 1953 to 1978) are included for oil and condensate, oil, gas, natural gasoline, and LPG, salt, sulfur, oil and gas lost. Production, value, and royalty, by years and products are given for 1978 for California, Louisiana, and Texas. A summary of bonuses, minimum royalties, rentals, shut-in gas payments, and totals by years, states, and products is given. Data on the 10 regions and total offshore and US production of oil and condensate and gas conclude the tabulations. (MCW)

48109 Biodegradable foaming agent in drilling and workover operations. Fischer, P.W.; Pye, D.S. (to Union Oil Co. of California). US Patent 4,121,664. 24 Oct 1978. Filed date 17 Oct 1977. 8p.

A method is describes for conducting foam drilling and workover operations in a bore hole penetrating a subterranean reservoir employing an aqueous solution of a biodegradable foaming agent composition containing about 0.1 to 1 part by weight of an N-fatty ethyl sulfate salt. A particularly preferred foaming agent composition contains sodium 2-(N-lauryl) ethyl sulfate and sodium laurate.

PROCESSING

REFER ALSO TO CITATION(S) 48128

48110 Addition of olefins to cat cracker feed to modify product selectivity and quality. Blazek, J.J. Sr.; Ritter, R.E. (to W.R. Grace and Co.). US Patent 4,146,465. 27 Mar 1979. Filed date 10 Feb 1978. 6p.

A process is described for increasing the octane rating of gasoline and decreasing the quantity of coke produced by a catalytic cracking process by adding C_2 to C_6 linear olefins to the feed to the reactor with a zeolite containing cracking catalyst. The olefins may be added separately or mixed with the gas oil feed just before the oil preheat section ahead of the reactor.

48111 Dilution chilling dewaxing by modification of tower temperature profile. Broadhurst, T.E.; Eagan, J.D.; Perry, S.F. (to Exxon Research and Engineering Co.). US Patent 4,146,461. 27 Mar 1979. Filed date 27 Dec 1977. 10p.

An improved DILCHILL dewaxing process is described wherein waxy lubricating oil stocks are solvent dewaxed by contacting them with successive increments of cold dewaxing solvent at a plurality of points along the height of a vertical tower divided into a plurality of stages while agitating the oilsolvent mixture in each stage to provide substantially instantaneous mixing of the waxy oil and solvent thereby precipitating wax from the oil while avoiding the well known shock chilling effect. The improvement resides in adjusting the cold solvent addition to each stage in a manner so as to modify the temperature profile along the tower to ensure that the temperature drop per stage in the initial stages in which wax precipitation occurs is greater than the temperature drop per stage in the final or later stages in which wax precipitation occurs.

48112 Temporary shutdown of CO-combustion devices. Graven, R.G.; Sailor, R.A. (to Mobil Oil Corp.). US Patent 4,146,464. 27 Mar 1979. Filed date 12 Sep 1977. 8p.

A metal combustion promoter is introduced into the circulating inventory of catalyst in the catalytic cracking process to temporarily change the operating mode of the regenerator and decrease the CO content of the flue gas, thus permitting temporary shutdown of the CO-boiler or CO-incinerator, while continuing operation of the catalytic cracking process. The metal combustion promoters are compounds of platinum, iridium, osmium, palladium, rhodium, ruthenium, or rhenium. The described technique permits rapid shutdown and minimizes the time of operation outside of compliance with local or other ordinances.

48113 Method for determining the sound-power levels of air-cooled (air-fin) heat exchangers. Marsh, K.J.; van't Sant, W.; Sutton, P. Den Haag, Netherlands; CONCAWE (1978). 24p. (NP—23819).

Air cooled heat exchangers are often the main source of neighborhood noise emitted by oil refineries and petrochemical works. Their noise emission may therefore be an important factor in the choise of units to be installed when the plant has to meet neighborhood-noise limits. The installation of low-noise fans can involve considerable extra cost and it is important to have reliable measurements of the noise emisson from different types of air-cooled heat exchangers to make the best selection before purchase and to test them after installation. Unfortunately, there is no standard test procedure for providing comparative data from different fan manufacturers. One of the firt tasks of the Special Task Force was to persuade manufacturers to use a test procedure based on the large-source method defined in the OCMA Noise Specification NWG-1. However, this method required closer defining in relation to air-fin fans and the present test method was developed to do this. It is an engineering method which can be used both on single fan test units and large multiple-fan units in refineries, covering most of the

configurations in common use. Measurements are made with a portable precision sound-level meter equipped with octave-band filters; equipment which might reasonably be expected to be available in a refinery or works. They can therefore be made by persons not specialized in acoustic measurements. Results are quoted as sound-power levels because this is the most useful parameter for calculating neighborhood noise.

PRODUCTS AND BY-PRODUCTS

REFER ALSO TO CITATION(S) 48763

48114 **New tax on gasoline: estimating its effect on consumption.** Schneider, A.M. (Univ. of California, San Diego, La Jolla). *Science;* **202**: No. 4369, 755-757(17 Nov 1978).

Based on extrapolation of a recent estimate of the elasticity of demand for gasoline, it is concluded that a tax of 5 cents per gallon per year over the period 1979 to 1988 can be expected to produce significant reductions in gasoline consumption, contrary to widely expressed opinions.

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 48131

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 48114, 48124, 48125, 48129, 48771, 48773

48115 (DOE/EIA—0184/6) **Estimate of the 1979 cost of oil imports into the United States. Analysis report.** (Department of Energy, Washington, DC (USA). Energy Information Administration). Jul 1979. 18p. Dep. NTIS, PC A02/MF A01.

This Analysis Report estimates the cost of imports into the 50 States, Puerto Rico and the Virgin Islands during the remainder of 1979 based on two different assumptions concerning U.S. demand and imports and world oil prices. The low demand estimate is based on low foreign supply and consequent high world oil prices, while the high demand is based upon high foreign supply and low prices. This analysis assumes that demand is not constrained by shortages of available imports of crude oil and may overestimate consumption and imports somewhat if actual shortages occur. The Census estimate of imports averaged 9.21 million barrels a day for the first quarter, at a free alongside ship cost of $11.58 billion. In the low demand projection series, using high world prices which dampen U.S. demand and imports of petroleum, total imports on a balance of payments basis would average 8.96 million barrels a day for the full year 1979 at a cost of $60.16 billion. In the high demand series, which incorporates a low world price, demand is higher and imports would average 9.91 million barrels a day. However, the annual cost would be less than in the low demand case, or $53.24 billion, with lower prices offsetting higher import volume.

48116 (DOE/EIA—0184/7) **Effect of legislative and regulatory actions on competition in petroleum markets. Analysis report: AR/EI/79-29.** Taschdjian, M. (Department of Energy, Washington, DC (USA). Energy Information Administration). Apr 1979. 76p. Dep. NTIS, PC A05/MF A01.

This study evaluates the combined effects of major legal and regulatory actions on competition in the domestic oil production and refining sectors. The historical periods before and after the oil embargo of 1973 are examined to determine the impact of the total regulatory framework first, on the process of competition, and second, on major classes of competitors. It is concluded that the combination of laws and regulations which were established after the Arab oil embargo had little impact on eliminating competition in oil production and refining. Impediments to competition that existed in these industries prior to the embargo were largely unchanged under the post-embargo generation of regulations.

48117 (LBL—8720) **Knowledge based system for providing intelligent access to a petroleum user database.** Rosenberg, S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jan 1979. Contract W-7405-ENG-48. 7p. Dep. NTIS, PC A02/MF A01.

This paper describes the design of a knowledge-based system for handling information concerning petroleum usage in the United States. The FRL language is used. Information is organized around the categories site, area, and company. (DLC)

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 48074, 49179, 49187, 49193, 49194

48118 (COO—4256-01) **Analyses of hydrocarbons in BLM sediment intercalibration sample from Santa Barbara basin and spiked with API South Louisiana crude oil. A preliminary report.** Farrington, J.W.; Tripp, B.W.; Sass, J. (Woods Hole Oceanographic Institution, MA (USA)). 1977. Contract EE-77-S-02-4256. 51p. Dep. NTIS, PC A04/MF A01.

A preliminary report is made of a BLM intercalibration sediment sample from the Santa Barbara basin spiked with South Louisiana crude oil. The two subsamples reported were analyzed by a procedure described in the appendix for which a separate abstract was written. Because of the high oil content of the sediment the usual thin layer chromatography procedure resulted in an overloaded plate. An appendix was indexed separately. (JSR)

48119 (COO—4256-01, pp 31p, Paper 1) **Analyses of aromatic hydrocarbons in intertidal sediments resulting from two spills of No. 2 fuel oil in Buzzards Bay, Massachusetts.** Teal, J.M. (Woods Hole Oceanographic Institution, MA); Burns, K.; Farrington, J. 1977.

In Analyses of hydrocarbons in BLM sediment intercalibration sample from Santa Barbara basin and spiked with API South Louisiana crude oil. A preliminary report.

We have analyzed the two and three ring aromatic hydrocarbons from the Wild Harbor oil spill, September 1969, and Winsor Cove oil spill in October 1974 in intertidal marsh sediments, using glass capillary gas chromatographic and mass fragmentographic analyses. Naphthalenes with 0 to 3 alkylsubstitutions and phenanthrenes with 0 to 2 substitutions decreased in concentration in surface sediments. The more substituted aromatics decreased relatively less and in some cases actually increased in absolute concentration. The changes in composition of the aromatic fraction have potential consequences for the ecosystem and provide insight into geochemical processes of oil weathering.

48120 (LA—7254-PR, pp 74-79) **Ecological consequences of petroleum developments in northern Alaska.** Hanson, W.C.; Eberhardt, L.E. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Field studies were conducted on arctic fox populations; lemming trapping; nesting bird populations; monitoring of photo-synthetic rates in lichen communities; use and quality of range components within the habitats used by the western arctic caribou herd; and ^{137}Cs body burdens of Eskimos of Anaktuvuk Pass. Tables are presented to show results. (HLW)

48121 **Oil concentration detector.** Pitt, G.D.; Smith, H.J. (to ITT Industries, Inc.). US Patent 4,146,799. 27 Mar 1979. Priority date 29 Oct 1976, United Kingdom of Great Britain and Northern Ireland (UK), 4p.

Apparatus for detecting oil in water contained in a chamber, wherein a semiconductor laser directs infrared radiation into the chamber. The radiation is scattered and detected by one or more cells. The output of one cell controls the gain of an amplifier connected from another cell. In one arragement, the outputs of two cells are connected to a differential amplifier, and the output of the differential amplifier, and the output of the differential amplifier is gain controlled by the output of a third cell.

48122 **System for collecting oil.** Shyu, J.Y. (to Yin-Lung Yang). US Patent 4,146,482. 27 Mar 1979. Filed date 22 Feb 1978. 2p.

This invention relates to apparatus for collecting oil floating on a sea surface. This is by a collecting panel and tube with the force of waves pushing oil mixed with water and dirt under some conditions, causing the oil to flow into said panel and tube automatically. The tube leads the oil to a container under sea level wherein the said oil and water can be separated and filtered, and then pure oil is pumped to a nearby ship for storage. Thus, not only pollution will be avoided but also the lost oil can be collected and reused.

48123 **V-shaped oil containment boom.** Steen, J.W.; Bennett, J.; McAllister, I. (to Bennett Pollution Controls, Ltd.). US Patent 4,146,344. 27 Mar 1979. Filed date 6 Jun 1977. 10p.

An oil containment boom is provided herein. It includes an elongated member of generally V-shaped cross-section, which is provided by a front wall section and a (preferably higher) rear wall section, joined together along respective lower edges. Ballast means are provided for normally maintaining the elongated member upright with the joint between the front and rear walls at the bottom. Float means (preferably inflatable) are provided, which are disposed between the front wall and the rear wall at a predetermined and preselected level above the joint. Drainage means are provided within the front wall to permit polluted liquid which has rolled over the front wall and is trapped in the V-shaped member constituted by the front and rear walls to escape therefrom to an area upstream of

the front wall. A novel method of containing oil spills in ice infested water is also provided.

POLICY, LEGISLATION, AND REGULATION

REFER ALSO TO CITATION(S) 48116, 48133

48124 (DOE/EIA—0184/3) **Effects of oil regulation on prices and quantities: a qualitative analysis.** Dickens, P.F. III. (Department of Energy, Washington, DC (USA). Energy Information Administration). May 1979. 101p. Dep. NTIS, PC A06/MF A01.

Effects of federal oil regulations on the markets for crude oil and its refined products are examined. The directions in which prices and quantities are altered by these regulations are determined by a qualitative economic analysis. Comparisons are made between the price and output decisions of the present markets and those decisions in the absence of these regulations. The general conclusion is that the oil regulations as a whole lead to generally lower prices and higher utilization of crude oil and refined products. (DLC)

48125 (DOE/ERA—6373) **Rationale for continued exemption of asphalt from mandatory petroleum allocation regulations.** (Resource Planning Associates, Inc., Cambridge, MA (USA)). Jul 1979. Contract EB-78-C-01-6373. 33p. Dep. NTIS, PC A03/MF A01.

As a basis for analyzing the effects of an oil shortage on the asphalt industry, a worst-case shortage resulting from a year-long, 1979 crude oil embargo by OAPEC was hypothesized. It is concluded that during such a 20% oil shortage, refiners would in general produce and distribute asphalt according to the relative priorities of its users, and asphalt's relative priority to other petroleum products. (DLC)

48126 (DOE/TIC—10445) **Report to Congress pursuant to Section 8(f)(l) of the Emergency Petroleum Allocation Act.** (Federal Energy Administration, Washington, DC (USA)). 23 Feb 1977. 149p. Dep. NTIS, PC A07/MF A01.

This report responds to the reporting requirement of Section 8(f)(l) of the Emergency Petroleum Allocation Act (EPAA) as amended by the Energy Policy and Conservation Act (EPCA) and Energy Conservation and Production Act (ECPA). Chapter II of this report describes in detail the requirements of the various laws and the actions that the Federal Energy Administration (FEA) has taken or will take to implement these laws through regulation. Chapter III provides details of FEA's rationale followed in implementing these provisions of the law and quantifies, where possible, the impacts believed to have resulted from the legislation in 1976 on price, production, supply and the economy. Since the eleven month period starting with February 1976 and ending in December of that year is short compared to the time required for the effects of price on production to be realized, forecasts of impacts are provided for 1980 and 1985 to offer a further dimension in understanding the effects of these provisions. Four appendices to Chapter III supply the details of the analytical methodology used. Finally, Chapter IV assesses the possible impacts of these provisions on future domestic crude oil production through an analysis of the response of the leading indicators of domestic crude oil production to changes in price.

48127 (DOE/TIC—10532) **Economic impact evaluation of the proposed amendments to the entitlements program for implementing purchase authority for the strategic petroleum reserve.** (Federal Energy Administration, Washington, DC (USA)). Feb 1977. 14p. Dep. NTIS, PC A02/MF A01.

The proposed amendments establish a specific method for financing oil acquisitions for the Reserve which, through the entitlements mechanism, allocates part of the costs of acquisitions to refiners and their customers, and the remainder of the costs presumably to general revenues. The proposed method of financing is probably superior to a benchmark case of only general taxation in the current period. Additionally, it distributes some of the costs through time until the expiration of controls in May 1979. The determination of who should bear the costs of the oil for the Strategic Petroleum Reserve is a political decision. However, the entitlements program's use places an uncertain portion of the cost burden on refiners and their customers due to the instability of its yield (the amount of cost reduction to the government) and its uncertainty of existence over a long period of time.

48128 (EMD—79-59) **United States refining policy in a changing world oil environment.** (General Accounting Office, Washington, DC (USA)). 29 Jun 1979. 33p. General Accounting Office, Dist. Section, 441 G Street, NW, Washington, DC.

Report to the Congress of the United States by the Comptroller General.

This study addresses the implications of international and domestic factors affecting the US refining industry. GAO has made observations in this report about the impacts of those factors as they affect the domestic refining industry, international markets, regulatory actions, and the national security. Growing US demand for refined products, considered in light of already idle excess refining capacity in the rest of the free world, uncertain supplies of crude oil, a rapidly diminishing sweet crude resource base, and downstream expansion plans of oil-producing nations raises serious questions about the future of the US domestic refining industry. Utilization of the US refining capacity will ultimately depend on the continued availability of adequate supplies of crude--an uncertain prospect at best.

48129 (ID—79-36) **Issues related to foreign oil supply diversification.** Fasick, J.K. (General Accounting Office, Washington, DC (USA)). 31 May 1979. 16p. General Accounting Office, Dist. Section, 441 G Street, NW, Washington, DC.

Senator Max Baucus and Congressman Donald Pease raised a series of questions about diversification of US foreign oil supply sources. This report answers their questions on the advantages of supply diversification, US support for the World Bank program to accelerate petroleum production in developing countries, and whether US oil companies were involved in developing the US position on the World Bank program for accelerating petroleum production in developing countries.

TRANSPORT, PIPELINES, AND HANDLING

48130 (AD-A—061492) **Military petroleum pipeline systems. Final report.** Studebaker, W.E. (Army Mobility Equipment Research and Development Center, Fort Belvoir, VA (USA)). Jun 1978. 252p. NTIS PC A12/MF A01.

The present Army capability to install, operate, and maintain petroleum product pipelines is examined in light of current commercial pipeline technology and projections of fuel consumption for combat units in the event of future hostilities. The objective of this investigation is to provide a measure of effectiveness for and determine the technical feasibility of alternative pipeline systems operating as subsystems in a large logistical system for distribution of fuels in a theater of operations during wartime conditions. A broad array of pipe materials, pipe joining techniques, pumping equipment, ancillary pipeline components, and system designs are evaluated. The findings indicate that substantive improvement in the operational effectiveness of military pipeline can be achieved using aluminum pipe and self-latching mechanical couplings in lieu of the existing military standard lightweight steel pipe joined by grooved-end, split-ring mechanical couplings. High-speed, medium-duty, diesel-engine-driven pump units are recommended for all pipeline pump station applications. Flexible hoselines are not an efficient or cost effective means for transporting large volumes of fuel over long distances.

48131 (PNL—2133) **Assessment of the risk of transporting gasoline by truck.** (Battelle Pacific Northwest Labs., Richland, WA (USA)). Nov 1978. Contract EY-76-C-06-1830. 190p. Dep. NTIS, PC A09/MF A01.

Based on shipping assumptions and the current accident rate of 2.5×10^{-6} per mile, it is estimated that gasoline tank trucks will be involved in 1,781 accidents in 1980, and that 110 of the accidents (about one in 15) will result in a release of 3,000 gallons of gasoline or more from the tank truck. About one in four of the releases are expected to result in a large fire. The estimated number of fatalities from the gasoline releases in 1980 is 29, with 12 of these fatalities being drivers of gasoline tank trucks, and the other 17 being occupants of other vehicles involved in the accident. Fatalities of other members of the public were found to occur infrequently. An additional 26 persons are expected to be fatally injured from the accident forces, regardless of the hazardous nature of the cargo. These total fatality figures (55) were compared to the prediction of 43 deaths of the Bureau of Motor Carrier Safety.

PROPERTIES

48132 (AD-A—061027) **Evaluation of motor gasoline in the jet fuel thermal oxidation tester. Final report, January 1976-July 1978.** Bradley, R.P. (Air Force Aero-Propulsion Lab., Wright-Patterson AFB, OH (USA)). Oct 1978. 46p. NTIS PC A03/MF A01.

Motor gasoline is a potential emergency fuel for aircraft using turbine engines. Due to the lack of data on the deposit forming tendencies of motor gasoline, a series of tests was conducted on four samples using the jet fuel thermal oxidation tester. The motor gasoline samples responded to exposure to high temperatures in a manner identical to the response of JP-4 with the exception that the breakpoint temperature was approximately 10 C below the specification limit for JP-4. Filter plugging was not a problem. The effect of contamination of JP-4 with motor gasoline was investigated. The thermal stability of the resulting blend may be lowered to the

thermal stability level of the motor gasoline. Hence, the blend may not meet JP-4 specification requirements. (Author)

STORAGE

48133 (DOE/TIC—10320) **Industrial Petroleum Reserve (IPR). Amendment No. 2 to final report.** (JRB Associates, Inc., McLean, VA (USA)). 7 Jan 1977. 30p. Dep. NTIS, PC A03/MF A01.

FEA has concluded that the benefits of an IPR are far outweighed by its costs. With the exception of the budgetary and conservation effects which would result from an IPR, all other benefits could be achieved with a carefully planned and designed SPR, fully owned by the USG. Moreover, if reduced government spending or the conservation benefits are desired or deemed necessary, there are much more efficient ways to achieve them than through the IPR. An excise tax, for example, could accomplish both of these objectives and at the same time avoid the numerous disadvantages and adverse aspects of an IPR.

48134 (SAND—79-0637) **Systems integration and engineering support sudy for the strategic petroleum reserve (SPR) program. Final report.** Ney, J.F.; Stoller, H.M. (Sandia Labs., Albuquerque, NM (USA)). Jun 1979. Contract EY-76-C-04-0789. 272p. Dep. NTIS, PC A12/MF A01.

A short-term systems integration and engineering support study was undertaken for the Strategic Petroleum Reserve (SPR) program. Objectives of the study were to: assess and evaluate the assumptions and criteria upon which the SPR program was established; identify potential technical problem areas; recommend R & D programs to address identified technical problems; assess the capabilities of the Early Storage Reserve (ESR) system; assess the capabilities of the proposed SPR system; and provide preliminary recommendations on systems engineering management needed to accomplish program objectives. This report describes the study effort and provides conclusions and recommendations in each area.

COMBUSTION

REFER ALSO TO CITATION(S) 48038, 48092, 48093, 48094, 48132

NATURAL GAS

RESERVES

REFER ALSO TO CITATION(S) 48087

48135 (EMD—78-68) **Natural gas reserves estimates: a good Federal program emerging, but problems and duplications persist.** Staats, E.B. (General Accounting Office, Washington, DC (USA)). 15 Jun 1979. 83p. General Accounting Office, Dist. Section, 441 G Street, NW, Washington, DC.

Report to the Congress of the United States by the Comptroller General.

The Department of Energy is developing a national program to collect estimates of natural gas reserves to meet various Government information needs. GAO believes the approach being used is appropriate because it proposes to collect the estimates from operators--those having the best knowledge of the reserves--and to use Federal personnel to verify the information through annual audits of the reports received. However, GAO doubts that all the data to be collected are needed to fulfill Government functions. Also, a pilot test of the survey form is not planned and a strong validation program must still be developed. Two other major, but less comprehensive, programs by the Federal Energy Regulatory Commission and the US Geological Survey are duplicative and should be cancelled.

GEOLOGY AND EXPLORATION

48136 (ORO—5200-8) **Devonian shales in eastern Ohio. Quarterly technical progress report, July 1, 1978—September 30, 1978.** Struble, R.A. (Ohio Dept. of Natural Resources, Columbus (USA)). 1978. Contract EY-76-S-05-5200. 24p. Dept. NTIS, MF A01.

Portions of document are illegible.

Research on the Devonian shales in eastern Ohio is reported. Milestones on resource inventory and shale characterization are listed. (DLC)

DRILLING, PRODUCTION, AND PROCESSING

REFER ALSO TO CITATION(S) 48103, 48108, 48999

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 48146

48137 (UCRL—82293) **Chemical kinetics in LNG detonations.** Westbrook, C.K.; Haselman, L.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Feb 1979. Contract W-7405-ENG-48. 25p. (CONF-790828—1). Dep. NTIS, PC A02/MF A01.

From 7. international colloquium on gas-dynamics of explosions and reactive systems; Gottingen, F.R. Germany (20 Aug 1979).

The problem of detonability of vaporized mixtures of liquified natural gas and air is addressed, using a characteristic time analysis. Separate numerical models are used to treat the evolution of the blast wave produced by a charge of high explosive and the chemical ignition delay of the fuel-air mixture. These models are combined with experimental data to predict the amount of high explosive required to initiate a detonation of a stoichiometric mixture of methane and air, giving an estimate of 50 to 100 kg of high explosive in spherical geometry. The effects of minor constituents such as ethane and propane on methane-air detonability are examined, and the mechanism by which these minor constituents kinetically sensitize the fuel is discussed. 5 figures, 1 table.

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 48771

48138 (NP—23852) **Natural gas supply and demand for California, 1978—1995.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 15 Mar 1978. 229p. California Energy Commission, Sacramento, CA.

The first part of this report addresses natural gas demand. The demand forecast includes mandated conservation standards, and the impacts of these existing standards on future gas demand are presented. Impacts of several additional proposed conservation measures and solar thermal applications are also developed. The second part addresses potential future gas resources, including both traditional or historic sources and new or supplemental supplies. The last part develops a series of options that balance forecast demand by combining firm traditional supplies with several different combinations of supplemental supply elements, including LNG. (DLC)

ENVIRONMENTAL EFFECTS

REFER ALSO TO CITATION(S) 49193, 49194

48139 (DOE/TIC—10524) **Alaska natural gas transportation system. Intergency task force on environmental issues.** (Department of the Interior, Washington, DC (USA)). 1 Jul 1977. 143p. Dep. NTIS, PC A07/MF A01.

This report is a critique of the Federal Power Commission's recommendation to the President. The critique concurs with the FPC conclusions that each of the three pending proposals will have some adverse environmental impacts. However, if the Alaska gas was allocated to maximize air quality benefits, the construction of a gas transportation system could be environmentally preferable from the standpoint of public health. The Arctic Gas route has the greatest potential for causing adverse environmental impacts. (DLC)

ARTIFICIAL STIMULATION, PLOWSHARE, ETC.

REFER ALSO TO CITATION(S) 48100

48140 (DOE/BG/01569—6) **Western Gas Sands Project. Status report, 1 March 1979—31 March 1979.** (CER Corp., Las Vegas, NV (USA)). 1979. Contract AC08-79BG01569. 81p. Dep. NTIS, PC A05/MF A01.

Progress of the government-sponsored projects directed toward increasing gas production from low-permeability gas sands of the western United States is summarized. During March, National Laboratories and Energy Technology Centers generally progressed on schedule. Bartlesville Energy Technology Center continued work on fracture conductivity, rock-fluid interaction, and log evaluation techniques. Theoretical and experimental work on hydraulic fracturing mechanics and analysis of well test data continued at

Lawrence Livermore Laboratory. Sandia Laboratories completed preparations for the NTS evaluation test of the borehole seismic system. M.D. Wood, Inc. monitored the formation of a hydraulic fracture in the Wattenburg gas field, Weld County, Colorado. Measurement of bottom-hole pressure in the Miller No. 1 and Sprague No. 1 wells for the CIG cyclic gas injection project continued. The Mitchell Energy Corporation Muse—Duke No. 1 was flowing 4,000 MCFD in March. Efforts to clean out Mobil's PCU F31-13G well continued.

48141 (DOE/BG/01569—7) **Western Gas Sands Project. Status report, April 1—April 30, 1979.** Atkinson, C.H. (CER Corp., Las Vegas, NV (USA)). 1979. Contract AC08-79BG01569. 80p. Dep. NTIS, PC A05/MF A01.

Progress of government-sponsored projects directed toward increasing gas production from the low-permeability gas sands of the western United States is summarized. Work by the USGS toward resource assessment in the four primary study areas continued. Bartlesville Energy Technology Center continued work on fracture conductivity, rock-fluid interaction, and log evaluation and interpretation techniques. Experimental and theoretical work on hydraulic fracturing mechanics and analysis of well test data continued at Lawrence Livermore Laboratory. Gathering of bottom-hole pressure data from the Miller No. 1 well and Sprague No. 1 well in the Wattenberg Field, Colorado continued. Fracturing fluid/rock interaction tests have been completed by Terra Tek for Gas Producing Enterprises, Inc., on sandstone horizons in the lower Mesaverde. The Mitchell Energy Corporation Muse-Duke No. 1 was flowed 4,000 MCFGD in April. Fishing operations on the Mobil PCU F31-13G well were unsuccessful. Six zones of the first horizontal experimental hole in the Sandia Laboratories interface test series were mined back to examine the behavior of the hydraulic fracture at the interface. Data collection by CER Corporation and TRW for GRI's Analysis of Tight Formations project continued.

48142 (NVO—0681-2) **Determination of the optimum massive hydraulic fracturing design for the stimulation of the Wasatch and Mesa Verde formations. Annual report.** Merrill, R.G. (Gas Producing Enterprises, Inc., Denver, CO (USA)). Jul 1978. Contract EY-76-C-08-0681. 58p. Dep. NTIS, PC A04/MF A01.

The MHF project in the Natural Buttes Unit, Bitter Creek Field, Utah has progressed through five of the eight phases of the scheduled program. The last three phases of the program are in progress. Two of the three remaining phases should be finished by 10-1-78, with the testing of CIGE 21-15-10-22 to continue until approximately 1-1-79. Results from this project indicate that MHF stimulations of low permeability sands such as the Mesa Verde—Wasatch are economically high risk. The technology necessary to perform an MHF is adequate; however, the results anticipated must be carefully evaluated with respect to economics.

48143 (SAND—79-1170C) **EGR stimulation research project - direct observation of hydraulic and dynamic fracturing.** Northrop, D.a.; Warpinski, N.R.; Schmidt, R.A. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 12p. (CONF-790805—9). Dep. NTIS, PC A02/MF A01.

From DOE symposium on enhanced oil and gas recovery and improved drillings technology; Tulsa, OK, USA (22 Aug 1979).

Conducting controlled fracturing experiments which are subsequently available for direct observation has been shown to be feasible and is producing significant new observations. Hydraulic fractures have been shown to be relatively unaffected by interfaces between formations with different properties. Specifically, the upwards growth of a fracture was not contained by an overlying formation with significantly higher modulus and rectangular, bounded fracture geometries should not be assumed. The High Energy Gas Frac has been shown to be a viable technique for creating multiple, randomly oriented fractures in a borehole. This field test has demonstrated that a propellant can be suitably designed to provide (1) a large enough loading rate to initiate multiple fractures, (2) high enough pressures to extend fractures radially, but not so high as to exceed the flow stress of the rock, and (3) sufficient gas generation to allow most of the fractures to be pressurized and propagated further.

POLICY, LEGISLATION, AND REGULATION

48144 (EMD—78-86) **Policy needed to guide natural gas regulation on Federal lands.** Staats, E.B. (General Accounting Office, Washington, DC (USA)). 15 Jun 1979. 83p. General Accounting Office, Dist. Section, 441 G Street, Washington, DC.

Report to the Congress of the United States by the Comptroller General.

The Government needs to establish (1) regulations to guide lessees' activities for the exploration, development, and production of natural gas from Federal lands and (2) a policy on the role of natural gas produced from Federal lands in the context of a national gas policy relative to the Nation's total energy needs and resources. The Department of Energy has taken little or no action to develop a policy. At the same time, the Department of the Interior is continuing to spend millions to study the production potential of developed fields on the Gulf of Mexico Outer Continental Shelf without the benefit of policy guidance.

TRANSPORT, PIPELINES, AND HANDLING

48145 (DOE/TIC—10486) **Report to the President: financing an Alaska natural gas transportation system.** (Department of Energy, Washington, DC (USA)). 1 Jul 1977. 318p. Dep. NTIS, PC A14/MF A01.

The principal conclusion of this report is that there is good reason to anticipate that an economically viable system to transport natural gas from Alaska to the lower 48 states can be privately financed - that is, without Federal financing assistance. A private financing, however, will be difficult, if not impossible, to arrange without prior resolution of a number of issues. The most important issues that must be resolved before any financing can be arranged include: the mechanism by which the wellhead price for gas is determined; the method by which gas will be priced to the ultimate consumer; the authorization of a sufficient flow of gas by the State of Alaska; negotiation of sales contracts between gas producers and gas transmission companies; a determination of the allowable rate of return; formation of a final consortium of equity investors in the project; and determination of the extent to which benefiting parties (including the producers of the gas, the State of Alaska, and gas consumers) will provide financing support to the project.

48146 (DOE/TIC—10492) **Alaska natural gas transportation system. Interagency Task Force on safety and design issue.** (Department of Transportation, Washington, DC (USA)). 1 Jul 1977. 47p. Dep. NTIS, PC A03/MF A01.

The safety and design issues in the Alaska natural gas transportation system relate primarily to how a recommended system should be designed, constructed, and operated, and to a lesser degree, where such a system should be located. This report discusses the relative safety and design merits of the three alternatives (Alcan, El Paso, and Arctic Gas) considered in the Federal Power Commission Recommendation to the President, May 1, 1977.

OIL SHALES AND TAR SANDS

REFER ALSO TO CITATION(S) 49424

DRILLING, FRACTURING, AND MINING

48147 **Explosive placement for explosive expnsion toward spaced apart voids.** French, G.B. (to Occidental Oil Shale, Inc.). US Patent 4,146,272. 27 Mar 1979. Filed date 14 Sep 1977. 28p.

A subterranean formation containing oil shale is prepared for in situ retoring by initially excavating a pair of spaced apart voids, leaving an intervening zone of unfragemented formation between the voids. The intervening zone has substantially parallel free faces adjoining the void. A plurality of elongated blasting holes are formed in the intervening zone of unfragemented formation, the longitudinal axis of each blasting hole being substantially perpendicular to the parallel free faces of the intervening zone. At least two deck loads of explosives are placed in each blasting hole, with each load being longitudinally spaced apart from each adjacent load by stemming. The loads of explosive are then detonated in a single round of explosions with a time delay between adjacent loads for expanding formation in the intervening zones toward both voids. The fragmented mass of formation particles is then retorted to recover shale oil from the oil shale.

OIL PRODUCTION, RECOVERY, AND REFINING

REFER ALSO TO CITATION(S) 48111

48148 **Bitumen-sodium hydroxide-water emulsion release agent for bituminous sands conveyor belt.** Sanford, E.; Shaw, R. (to Her Majesty the Queen in right of the Province of Alberta). US Patent 4,146,125. 27 Mar 1979. Filed date 1 Nov 1977. 4p.

An emulsion of bitumen in sodium hydroxide solution containing at least 1 wt. % bitumen as the disperse phase is useful, when spread over the load-bearing surface of a conveyor carrying bituminous sands, to act as a release agent to promote the clean separation

of the tacky sands from the belt when the latter rounds the end roller of the conveyor system and unloads the sands.

IN SITU METHODS, TRUE AND MODIFIED

REFER ALSO TO CITATION(S) 48147, 48156

48149 (FE—1747-7) **BX In Situ Oil Shale Project. Quarterly technical progress report, September 1—November 31, 1978.** Dougan, P.M. (Equity Oil Co., Salt Lake City, UT (USA)). 15 Dec 1978. Contract ET-78-F-03-1747. 66p. Dep. NTIS, PC A04/MF A01.

The construction of surface facilities at the BX In Situ Oil Shale Project continued during the quarter. All Project wells were completed, and the first tests using the flow retorting system of the Laboratory Research Program were conducted. Pre-startup environmental monitoring continued and the first quarterly report on air resources was prepared.

48150 **Apparatus and method for in situ heat processing of hydrocarbonaceous formations.** Bridges, J.; Ridge, P.; Taflove, A. (to IIT Research Inst.). US Patent 4,144,935. 20 Mar 1979. Filed date 29 Aug 1977. 26p.

The disclosure describes a technique for uniform heating of relatively large blocks of hydrocarbonaceous formations in situ using radio frequency (RF) electrical energy that is substantially confined to the volume to be heated and effects of dielectric heating of the formations. An important aspect of the disclosure relates to the fact that certain hydrocarbonaceous earth formations, for example raw unheated oil shale, exhibit dielectric absorption characteristics in the radio frequency range. In accordance with the system of the invention, a plurality of conductors are inserted in the formations and bound a particular volume of the formations. The phrase bounding a particular volume is intended to mean that the volume is enclossed on at least two sides thereof. electrical excitation is provided for establishing alternating electric fields in the volume. The frequency of the excitation is selected as a function of the dimensions of the volume so as to establish a substantially non-radiating electric field which is substantially confined in the volume. In this manner, volumetric dielectric heating of the formations will occur to effect approximately uniform controlled heating of the volume.

48151 **Gas stream cleaning system and method.** Kunchal, S.K.; Erck, L.J.; Harris, H.A. US Patent 4,145,191. 20 Mar 1979. Filed date 13 Apr 1977. 8p.

An oil mist and solid particle laden gas from an oil shale retorting operation is initially treated with a temperature controlled oil spray and then by a coalescer to reduce the quantity of oil mist and remove most of the solid particle content of the gas stream and then finally treated by an electrostatic precipitator to essentially remove the oil mist remaining in the gas.

SURFACE METHODS

REFER ALSO TO CITATION(S) 48151

PROPERTIES AND COMPOSITION

REFER ALSO TO CITATION(S) 48154

48152 (FE—8028-1) **Prediction of in-situ stresses from directional properties of rock cores for field development of Devonian shale.** Peng, S.S.; Okubo, S. (West Virginia Univ., Morgantown (USA). Coll. of Mineral and Energy Resources). Aug 1977. Contract EY-76-S-21-8028. 65p. Dep. NTIS, PC A04/MF A01.

The directional properties of Devonian shale were determined through four physical property measurements: Ultrasonic Velocity Measurement, Point Load Test, Brazilian Test and Measurement of Directional Elastic Constants. The core was taken from Well No. 20403 in Lincoln County, WV. The core with a total of 500 ft. consists of the following three sections: 2720 to 2836 ft., 3402 to 3473, and 3710 to 4026 ft. depth. The results of laboratory core analyses are as follows: (1) bedding planes are quite distinct; (2) the most preferred direction of fractures in the bedding plane is the 60° direction (N 60°E).

48153 (LBL—8901) **Intercomparison study of elemental abundances in raw and spent oil shales.** Fox, J.P.; Evans, J.C.; Wildeman, T.R.; Fruchter, J.S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1979. Contract W-7405-ENG-48. 25p. (CONF-790334—11). Dep. NTIS, PC A02/MF A01.

From Oil shale symposium; Denver, CO, USA (26 Mar 1979).

Two samples each of raw oil shale and spent oil shale were prepared as reference samples and analyzed by four laboratories using neutron activation analysis, x-ray fluorescence spectrometry, atomic absorption spectroscopy, and other techniques. Excellent agreement was obtained between techniques and laboratories except for the thin-film XRF technique. The %RMS deviations were less than or equal to 10% for 85% of the values. In general, the INAA analysis procedures yielded the most accurate and precise results. The XRF and colorimetric methods compared well with INAA but they were not as precise. Poor interlaboratory agreement was obtained for Cr, Co, Dy, and Sm by INAA, and an analytical problem was noted for As and Zr. Additional work is required to develop and validate reliable methods for B, F, Cd, and As.

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 49279

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 48771

WASTE RESEARCH AND MANAGEMENT

REFER ALSO TO CITATION(S) 48070, 48155

ENVIROMENTAL ASPECTS

REFER ALSO TO CITATION(S) 49125, 49230, 49236

48154 (COO—4017-3) **Trace elements in oil shale. Progress report, 1976—1979.** Chappell, W.R. (Colorado Univ., Boulder (USA)). 1979. Contract EY-76-S-02-4017. 333p. Dep. NTIS, PC A15/MF A01.

The overall objective of the program is to evaluate the environmental and health consequences of the release of toxic trace elements (As, B, F, Mo, Se) by shale oil production and use. Some of the particularly significant results are: The baseline geochemical survey shows that stable trace elements maps can be constructed for numerous elements and that the trends observed are related to geologic and climatic factors. Shale retorted by above-ground processes tends to be very homogeneous (both in space and in time) in trace element content. This implies that the number of analytical determinations required of processed shales is not large. Leachate studies show that significant amounts of B, F, And Mo are released from retorted shales and while B and Mo are rapidly flushed out, F is not. On the other hand, As, Se, and most other trace elements ae not present in significant quantities. Significant amounts of F and B are also found in leachates of raw shales. Very large concentrations of reduced sulfur species are found in leachates of processed shale. Upon oxidation a drastic lowering in pH is observed. Preliminary data indicates that this oxidation is catalyzed by bacteria. Very high levels of B and Mo are taken up in some plants growing on processed shale with and without soil cover. These amounts depend upon the process and various site specific characteristics. In general, the amounts taken up decrease with increasing soil cover. On the other hand, we have not observed significant uptake of As, Se, and F into plants. There is a tendency for some trace elements to associate with specific organic fractions, indicating that organic chelation or complexation may play an important role. In particular, most of the Cd, Se, and Cr in shale oil is associated with the organic fraction containing most of the nitrogen-containing compounds.

48155 (LBL—8997) **Water quality effects of leachates from an in situ oil shale industry.** Fox, J.P. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Apr 1979. Contract W-7405-ENG-48. 40p. Dep. NTIS, PC A03/MF A01.

This study is an attempt to pull together available information on the leaching of residuals from an in situ oil shale facility. The report evaluates the effect of leachate from abandoned in situ retorts and surface disposal piles of a 100,000 bbl/day, modified in situ facility on the quality of the surface water and groundwater of the Upper Colorado River Basin.

48156 (LETC/RI—79/03) **Summary of the environmental monitoring at the Rock Springs, Wyoming Site No. 9, true in situ oil shale retorting experiment.** Virgona, J.E.; Poulson, R.E.; Spedding, T.J. (Department of Energy, Laramie, WY (USA). Laramie Energy Technology Center). Jun 1979. 55p. Dep. NTIS, PC A04/MF A01.

The environmental effects and needed control technology associated with the potential in-situ retorting of oil shale in the Green River Basin (near Rock Springs, Wyoming) has been studied for over four years. This environmental monitoring program has included previous and existing in-situ oil-shale retorting field experiments and baseline data collection for potential future retorting experiments. The most extensive environmetal monitoring effort is at Rock Springs Site No. 9, a true in-situ oil-shale retorting field

experiment which was ignited April 5, 1976. The purpose of this monitoring program was to identify any significant changes in the hydrology, air quality, and soils. Data have been collected during the pre-operational (baseline) and operational phases and continues to be collected during the post-operational phase. This report presents the results of the environmental monitoring conducted in support of the LETC Rock Springs No. 9 field experiment and the entire DOE oil shale program. 18 figures, 8 tables.

NUCLEAR FUELS

RESERVES

REFER ALSO TO CITATION(S) 48067

48157 (GJO—100(79)) **Statistical data of the uranium industry.** (Department of Energy, Grand Junction, CO (USA). Grand Junction Office). 1 Jan 1979. Contract EY-76-C-13-1664. 136p. Dep. NTIS, PC A07/MF A01.

The Statistical Data of the Uranium Industry is a compilation of historical facts and figures through 1978. These statistics are based primarily on information provided voluntarily by the uranium exploration, mining, and milling companies. This publication is compiled and updated annually by the Grand Junction Office (GJO). Most of the numbers reported herein have been rounded. The production, reserves, drilling, and production capability information has been reported in a manner which avoids disclosure of proprietary information. The nomenclature of DOE's forward cost ore reserve estimates has been changed to reserve estimates because ore usually connotes material which can be extracted at a profit. Also, because of some confusion, we emphasize that this book follows the common industry practice of reporting mine production, reserves, and potential resources as tons of U_3O_8 in ore and reporting mill production as tons of U_3O_8 in concentrate. Uranium inventories for Texas have been added. The distribution of $50 reserves by mining method in producing and nonproducing properties has been newly included. An analysis of costs associated with production capability has been added (Appendix B). A probabilistic analysis of reserves has been introduced this year. The technical methodology for this analysis is outlined, and probability distribution curves for the 1/1/79 $30 and $50 reserves are presented.

48158 (LA-tr—78-69) **Complementary neutron studies about the Oklo phenomenon.** Naudet, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1978. Translation of IAEA-TC—119/21. (CONF-771222—21(Trans)). 29p. Dep. NTIS, PC A03/MF A01.

From IAEA symposium on natural fission reactors; Paris, France (19 Dec 1977).

At the colloquium of Libreville it was demonstrated that the classical methods of reactor physics were applicable to the Oklo phenomenon. The BINOCLE code, which calculates the neutron balance in a multiple environment like that of the ore at Oklo in a very detailed manner during the reaction period, was perfected. Several effects are calculated in a very detailed fashion, in particular those of the temperatures; the code was adjusted to operate with more precision and the ease of its application was improved by the addition of supplementary loops. The CRITO code calculates flux distributions and their associated characteristics in a reactor as formed by juxtaposition of different environments. Some examples of applications will be given. The spectral indices and conversion coefficients are characteristics that are available for measurements which provide information about the quantities of water present at the moment of reaction; their interpretation will be discussed. The question of reflectors, i.e., the role played by the ore with marginal uranium content surrounding the heart of the reactor, has been investigated; in particular the rapidity of decay of the neutron flux in the environments was calculated as function of their characteristics; finally, the attempt was made to correlate the distributions of measured reaction rates for a certain number of cases: section 2'P, test soundings SC 30, SC 30 a second time and SC 36; the shapes of the curves have been extremely well correlated and the role of certain parameters, like the distribution of the water or the amount of neutron contaminants present during the reaction period, can be discussed.

EXPLORATION

48159 (GJBX—11(79)) **NURE 1978 annual activity report.** (Bendix Field Engineering Corp., Grand Junction, CO (USA)). Jun 1979. Contract EY-76-C-13-1664. 119p. Dep. NTIS, PC A06/MF A01.

Technical activities undertaken during calender year 1978 to support DOE's National Uranium Resource Evaluation program are summarized. These activities include quadrangle evaluation, aerial radiometric reconnaissance and detail surveys, subsurface investigations, hydrogeochemical and stream-sediment reconnaissance, and geologic studies.

48160 (GJBX—88(79)(Vol.2)MARFA) **NURE aerial gamma-ray and magnetic reconnaissance survey: Big Bend area, MARFA MH 13-5, Fort Stockton MH 13-6, Presidio MH 13-8, and Emory Peak MH 13-9 quadrangles.** (LKB Resources, Inc., Huntingdon Valley, PA (USA)). Feb 1979. Contract EY-76-C-13-1664. 252p. Dep. NTIS, PC A12/MF A01.

Flight line profile data and statistical analysis result from the NURE aerial gamma-ray and magnetic reconnaissance survey of the Marfa MH 13-5 quadrangle in the Big Bend area of Texas. (LK)

48161 (GJBX—95(79)(Vol.2)(Leadville)) **Aerial gamma ray and magnetic survey: Uncompahgre Uplift Project, Leadville Quadrangle, Colorado. Final report.** (GeoMetrics, Inc., Sunnyvale, CA (USA)). Apr 1979. Contract EY-76-C-13-1664. 316p. Dep. NTIS, PC A14/MF A01.

The quadrangle includes parts of the Colorado Plateau and Southern Rocky Mountains. The Colorado Plateau portion corresponds to the Piceance Basin which contains great thickness of sedimentary material of Phanerozoic age. These materials range from zero to about 2000 ft thick in most of the Southern Rocky Mountains. The major uplifted areas are in the Southern Rocky Mountains part of the quadrangle and include the White River, Sawatch, and Sierra Madre-Park Range Uplifts. A basement complex of Precambrian age intrusive and metamorphic rocks is exposed over extensive areas in the core of the Sawatch and Sierra Madre-Park Range Uplifts and in a few small areas over the White River Uplift. The literature consulted included information on about 55 separate occurrences of radioactive minerals and/or anomalous radioactivity within the quadrangle. Many occurrences of fracture controlled mineralization are reported from the precious and base metal mining districts of Aspen, Sait Kevin-Sugar Loaf and Leadville. Only a few similar occurrences are reported elsewhere in the quadrangle. Many forms of mineralization, which appear to be stratigraphically controlled, occur in Paleozoic and Mesozoic rocks in the north 1/2 of the quadrangle. Uranium production is recorded from eight mines in the quadrangle. Five of these are clustered near Rifle, Colorado; one is near Aspen, Colorado and the remaining two, from which production is negligible, are located in the northeast 1/4 of the quadrangle. A total of 93 anomalies in the uranium channel meet the minimum statistical requirements as defined in the Interpretation Methods section of Volume I of this report. Magnetic data clearly distinguish between areas of thick and thin cover over the Precambrian crystalline basement. They also indicate the probable presence of higher susceptibility intrusive bodies in the Southern Rocky Mountains. Some of these intrusives are exposed at the surface.

48162 (GJBX—95(79)(Vol.2)(Moab)) **Aerial gamma ray and magnetic survey: Uncompahgre Uplift Project, Moab Quadrangle, Utah and Colorado. Final report.** (GeoMetrics, Inc., Sunnyvale, CA (USA)). Apr 1979. Contract EY-76-C-13-1664. 320p. Dep. NTIS, PC A14/MF A01.

Two major tectonic structures, the Uncompahgre Uplift and the Paradox Basin, occupy most of the Moab Quadrangle area. A thick sequence of Paleozoic and Mesozoic beds overlie a basement complex of Precambrian crystalline rocks in the Paradox Basin. A relatively thin sequence of Mesozoic beds overlie Precambrian rocks over the Uncompahgre Uplift. Mesozoic rocks are important with regard to both the large area they occupy (77% of the quadrangle) and their role in hosting uranium deposits. Magnetic data clearly illustrate the relative depth to the Precambrian crystalline rocks, and sharply define the boundary between the Uncompahgre Uplift and the Paradox Basin. They also indicate the probable presence of higher susceptibility intrusive bodies which have been emplaced in the Paleozoic and Mesozoic rocks of the Paradox Basin. Some of these intrusives are exposed at the surface. The Moab Quadrangle includes what has been one of the more productive uranium mining areas in the United States. Most of the deposits here are one of a variety of peneconcordant deposits which occur in sedimentary beds and which lack features commonly associated with deposits of hydrothermal origin. Such deposits are commonly believed to have formed by precipitation of uranium from circulating meteoric and/or connate water. Collectively, the Triassic Chinle Formation and the Jurassic Morrison Formation, both of stream and lakebed origin, contain most of the known uranium deposits in the quadrangle. Most of the remaining uranium deposits are scattered throughout other Mesozoic units. A relatively small number of deposits are in rocks of Permian and Pennsylvanian age. A total of 88 responses in the uranium channel constitute anomalies as defined in Volume I.

48163 (GJBX—95(79)(Vol.2)(Montrose)) **Aerial gamma ray and magnetic survey: Uncompahgre Uplift Project, Montrose Quadrangle,**

Colorado. Final report. (GeoMetrics, Inc., Sunnyvale, CA (USA)). Apr 1979. Contract EY-76-C-13-1664. 374p. Dep. NTIS, PC A16/MF A01.

The quadrangle includes portions of the Colorado Plateau and southern Rocky Mountains Physiographic Provinces. The entire area of the Gunnison Uplift and parts of the Uncompahgre and Sawatch Uplifts are included. A part of the Piceance Basin and a segment of the Rio Grande Rift Valley are also included. A basement complex of Precambrian metamorphic and igneous rocks is exposed in the core of the Gunnison and Sawatch Uplifts in the Southern Rocky Mountains. Jurassic and Cretaceous age sedimentary rocks lie directly on the Precambrian basement in most places. They lie on Paleozoic rocks at the west edge of the Sawatch Uplift in the north-central part of the quadrangle. Triassic beds are mapped only in the canyon of the Uncompahgre River near the southwest corner of the quadrangle. A suite of Tertiary volcanics and some sedimentary rocks occupy extensive areas. Plutonic rocks of Tertiary and laramide age occupy only a small part of the quadrangle. The literature consulted included information on about 100 separate occurrences of radioactive minerals and/or anomalous radioactivity within the quadrangle. Many fracture and stratigraphically controlled forms are reported. Most of these occurrences are clustered in three areas: Cochetopa Creek, Cebolla Creek, and Marshall Pass. Important uranium production is recorded from deposits in the Cochetopa Creek and Marshall Pass areas. A total of 220 anomalies in the uranium channel meet the minimum requirements as defined in the Interpretation methods section of Volume I of this report. A few of them appear to be related to known economic deposits, and provide examples for comparison with anomalies in other parts of the quadrangle where radioactive mineral occurrences have not been reported.

48164 (GJBX—95(79)(Vol.2)(Salina)) **Aerial gamma ray and magnetic survey: Uncompahgre Uplift Project, Salina Quadrangle, Utah.** (GeoMetrics, Inc., Sunnyvale, CA (USA)). Apr 1979. Contract EY-76-C-13-1664. 360p. Dep. NTIS, PC A16/MF A01.

The quadrangle lies entirely within the Colorado Plateau Physiographic Province. It includes a large part of the San Rafael Swell and smaller parts of the Monument and Circle Cliffs Uplifts. A thick sequence of Mesozoic and Paleozoic sedimentary rocks overlie the Precambrian basement over the entire quadrangle. Tertiary volcanics of the high Plateaus Volcanic Area overlie Paleozoic and Mesozoic rocks in the western 1/4 of the quadrangle. More than 240 uranium mines and prospects are documented in the quadrangle. Most deposits are in the Morrison and Chinle Formations. Almost all of them are one of a variety of peneconcordant deposits which occur in sedimentary beds and which lack features commonly associated with deposits of hydrothermal origin. Such deposits are commonly believed to have formed by precipitation of uranium from circulating meteoric and/or connate water. A total of 181 anomalies in the uranium channel meet the minimum requirements as defined in the Interpretation Methods section of Volume I of this report. These anomalies occur in 43 different map units. A minimum of 11 anomalies are related to known mineralized areas. Probable cultural sources account for at least 11 anomalies. Magnetic Data clearly distinguishes between areas of thick and thin cover over the precambrian basement. The volcanics of the High Plateaus Volcanic Area are also clearly distinguishable by the magnetic data.

48165 (GJBX—96(79)(Vol.1)) **Aerial radiometric and magnetic survey: White Sulphur Springs National Topographic Map, Montana.** (Geodata International, Inc., Dallas, TX (USA)). May 1979. Contract EY-76-C-13-1664. 223p. Dep. NTIS, PC E13/MF E13.

The results of analyses of the airborne gamma radiation and total magnetic field survey flown for the region identified as the White Sulphur Springs National Topographic Map NL12-5 are presented in Volume I and II of this report. The airborne data gathered are reduced by ground computer facilities to yield profile plots of the basic uranium, thorium, and potassium equivalent gamma radiation intensities, ratios of these intensities, aircraft altitude above the earth's surface, total gamma ray and earth's magnetic field intensity, correlated as a function of geologic units. The distribution of data within each geologic unit, for all surveyed map lines and tie lines, has been calculated and is included. Two sets of profiled data for each line are included with one set displaying the above-cited data. The second set includes only flight line magnetic field, temperature, pressure, altitude data plus magnetic field data as measured at a base station. A general description of the area, including descriptions of the various geologic units and the corresponding airborne data, is included also.

48166 (GJBX—96(79)(Vol.2)) **Aerial radiometric and magnetic survey: White Sulphur Springs National Topographic Map, Montana.** (Geodata International, Inc., Dallas, TX (USA)). 1979. Contract EY-76-C-13-1664. 144p. Dep. NTIS, PC A07/MF A01.

High Life Helicopters, Inc., Puyallup, Washington, conducted an airborne gamma ray and total magnetic field survey during the period July 14, 1978 to July 25, 1978. The survey covered a region of the state of Montana identified as the White Sulphur Springs National Topographic Map NL12-5. The specific area was surveyed from a rotary-wing aircraft using large-volume radiation detectors with associated airborne electronic equipment. Each map line was flown in an east-west direction with an average length of 98 miles, and each tie line was flown in a north-south direction with an average length of 69 miles. Map lines and tie lines were surveyed using a Lama helicopter. All data reduction and reporting for this survey were subcontracted to Geodata International, Inc. of Dallas, Texas. This report is separated into two volumes. Volume I gives the description of the program and results, and Volume II presents the flight line profile data and statistical analysis results.

48167 (GJBX—98(79)(Vol.1)) **Aerial radiometric and magnetic survey: Crystal City National Topographic Map, Texas Gulf Coast.** (Geodata International, Inc., Dallas, TX (USA)). 23 May 1979. Contract EY-76-C-13-1664. 149p. Dep. NTIS, PC E11/MF E11.

The results of analyses of the airborne gamma radiation and total magnetic field survey flown for the region identified as the Crystal City National Topographic Map NH14-11 are presented in Volume I and II of this report. The airborne data gathered are reduced by ground computer facilities to yield profile plots of the basic uranium, thorium, and potassium equivalent gamma radiation intensities, ratios of these intensities, aircraft altitude above the earth's surface, total gamma ray and earth's magnetic field intensity, correlated as a function of geologic units. The distribution of data within each geologic unit, for all surveyed map lines and tie lines, has been calculated and is included. Two sets of profiled data for each line are included with one set displaying the above-cited data. The second set includes only flight line magnetic field, temperature, pressure, altitude data plus magnetic field data as measured at a base station. A general description of the area, including descriptions of the various geologic units and the corresponding airborne data, is included also.

48168 (GJBX—98(79)(Vol.2)) **Aerial radiometric and magnetic survey: Crystal City National Topographic Map, Texas Gulf Coast.** (Geodata International, Inc., Dallas, TX (USA)). 23 May 1979. Contract EY-76-C-13-1664. 160p. Dep. NTIS, PC A08/MF A01.

Geodata International, Inc., Dallas, Texas, conducted an airborne gamma ray and total magnetic field survey of the Texas Gulf Coast area during the period from March 20, 1977 to May 4, 1977. This survey covered all or parts of the following National Topographic Maps: Houston, Seguin, Austin, Crystal City, Beeville/Bay City, Corpus Christi/Laredo, and Brownsville/McAllen. Each map line was flown in an east-west direction with a maximum combined length of 120 miles, and each tie line was flown in a north-south direction with a maximum length of 69 miles. The Crystal City NTMS report consists of two volumes with Volume I giving the description of the program and results, and Volume 2 giving the flight line profile data and statistical analysis results.

48169 (IS—4705) **Multilaboratory analytical quality control for the hydrogeochemical and stream sediment reconnaissance. Quality control report for May 1979.** D'Silva, A.P.; Floyd, M.A.; Haas, W.J. Jr. (Ames Lab., IA (USA)). Jun 1979. Contract W-7405-ENG-82. 28p. Dep. NTIS, PC A03/MF A01.

For the month of May 1979, Ames Laboratory received the following number of results: for batch Water A4 - 0.98 ppB U, LASL 4 F and ORGDP 2F; for batch Water B4 - 9.85 ppB U, LASL 4 F and ORGDP 2 F; for batch Sediment R3 - 5 ppM U, ORGDP 9 F, 7 DNC; for batch Sediment S1 - 10 ppM U, ORGDP 8 F, 10 DNC; where F is fluorometric and DNC is delayed neutron counting.

48170 Method for exploring and discovering uranium deposits within a petrofluid system. Gentry, R.V.; Thomas, I.L.; Hann, R.L. (to Dept. of Energy). US Patent A 936,459. 24 Aug 1978. 11p.

This invention relates to a method for exploring and discovering a uranium ore deposit located within a petrofluid system, comprising assaying the fluids and solids at a multiplicity of sites throughout the system with respect to at least four uranium daughter products, polonium-210, lead-210, bismuth-214, and radon-222 and thereby determining distances from the ore deposit to the assay point.

MINING

REFER ALSO TO CITATION(S) 48071, 48236

48171 (BM-IC—8796) **Cost of producing U_3O_8 from ammonium bicarbonate in situ leach solution by the multiple-compartment ion-exchange system.** Hayashi, M.; Dolezal, H. (Bureau of Mines, Salt Lake City, UT (USA). Salt Lake City Metallurgy Research Center). 1979. 17p. Bureau of Mines, Washington, DC.

The Bureau of Mines estimated the cost for a uranium ion-exchange recovery system using five grades of U_3O_8 leach solution producing 815,570 pounds of U_3O_8 per year from an ammonium

bicarbonate in situ leach solution. The system flowsheet consisted of four unit operations: (1) Multiple-compartment ion-exchange (MCIX) absorption; (2) MCIX elution; (3) precipitation of the uranium as yellow cake, filtering, calcining, and packaging; and (4) waste disposal. The total fixed capital cost of a system treating 2,000 gallons per minute of 0.1-gram-per-liter-U_3O_8 leach solution was estimated as $6,888,000. For a basic case of an MCIX system depreciating in 9 years, unit production cost of U_3O_8 was $3.51 per pound. A decrease in feed solution grade from 0.4 to 0.03 gram per liter increased the production cost exponentially. Shorter depreciating periods significantly increased the production cost particularly for the lower grade feed solutions.

FEED PROCESSING

REFER ALSO TO CITATION(S) 48071

48172 Preparation of U_3O_8. Johnson, D.R. (to Dept. of Energy). US Patent A 936,460. 24 Aug 1978. 9p.

A method is described for the preparation of U_3O_8 nuclear fuel material by direct precipitation of uranyl formate monohydrate from uranyl nitrate solution. The uranyl formate monohydrate precipitate is removed, dried and calcined to produce U_3O_8 having a controlled particle size distribution.

ENRICHMENT

48173 (K/TD—394) **Uranium enrichment: a review of the present world status - capacity, technology, and plans.** Wilcox, W.J. Jr. (Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). 15 Feb 1979. Contract W-7405-ENG-26. 64p. Dep. NTIS, PC A04/MF A01.

An overview is given of the evaluation and status of uranium enrichment processes: gaseous diffusion, gas centrifuge, and laser isotope separation. The uranium enrichment market (supply and demand) is also reviewed. The gradual enroachment of foreign enrichment capacity on US enrichment is pointed out. 49 figures. (DLC)

CENTRIFUGATION

48174 (Y/DS—100(Rev.1)) **Projected uranium measurement uncertainties for the gas centrifuge enrichmentplant.** Younkin, J.M. (Oak Ridge Y-12 Plant, TN (USA)). Jul 1979. Contract W-7405-ENG-26. 19p. Dep. NTIS, PC A02/MF A01.

An analysis was made of the uncertainties associated with the measurements of the declared uranium feed streams in the GCEP. The UF_6 streams, representing the largest amount of uranium, produce the largest component of uncertainty. The systematic component of uncertainty of the UF_6 streams is the largest contributor to the total uncertainty. The random component of the UF_6 streams and the wastes measurement uncertainties are about equal in magnitude and only minor contributors to the total uncertainty. The total uncertainty for the GCEP is projected to be from 65 to 130 kg ^{235}U/year out of a measured total of 200,000 kg ^{235}U/year. (DLC)

LASER EXCITATION

REFER ALSO TO CITATION(S) 48232

FUELS PRODUCTION AND PROPERTIES

REFER ALSO TO CITATION(S) 48243, 48901

48175 (CONF-790666—1) **Chemical flowsheet conditions for preparing urania spheres by internal gelation.** Haas, P.A.; Begovich, J.M.; Ryon, A.D.; Vavruska, J.S. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 70p. Dep. NTIS, PC A04/MF A01.

From 34. Northwest regional meeting of the American Chemical Society; Richland, WA, USA (13 Jun 1979).

Small, ceramic urania spheres can be prepared for use as nuclear fuel by internal chemical gelation of uranyl nitrate solution droplets. Decomposition of hexamethylenetetramine (HMTA) dissolved in the uranyl nitrate solution releases ammonia to precipitate hydrated UO_3. Previously established flowsheet conditions have been improved and modified at ORNL and have been applied to prepare dense UO_2 spheres with average diameters of 1200, 300, and 30 μm. Acid-deficient uranyl nitrate (ADUN) solutions up to 3.4 M in uranium with NO_3^-/U mole ratios of 1.5 to 1.7 are prepared by dissolution of U_3O_8 or UO_3. Continuous mixing of metered, cooled ADUN containing urea and HMTA solutions provides a smooth, regulated flow of the temperature-sensitive feed solution. The gelation times for solution drops in organic liquids at 45 to 95°C depend on both the chemical reaction rates and the rates of heat transfer. The gel properties vary with temperature and other gelation variables. Gelation conditions were determined which allow easy washing, drying, firing, and sintering to produce dense UO_2 spheres of all three sizes. The 1200- and 300-μm UO_2 spheres were pepared by gelation in trichloroethylene at 50 to 65°C; 2-ethyl-l-hexanol was used as the gelation medium to prepare 30-μm UO_2 spheres. Washing and drying requirements were determined. The gel dried to 225°C contains about 95% UO_3; the remaining components are H_2O, NH_3^-, which are volatilized during firing to UO_2.

48176 (HEDL-SA—1694-FP) **Nuclear fuel powder flow characterization.** Densley, P.J.; Carson, J.W. (Hanford Engineering Development Lab., Richland, WA (USA)). Apr 1979. Contract EY-76-C-14-2170. 43p. (CONF-790420—19). Dep. NTIS, PC A03/MF A01.

From International symposium on ceramics in nuclear waste management; Cincinnati, OH, USA (30 Apr 1979).

Based upon the flow characteristics of nuclear powders, a mass flow hopper required for dependable gravity flow would have outlet diameters of at least 11 inches (28 cm). Vibration of the hopper as well as storage in the hopper result in larger outlet openings for mass flow hoppers.

48177 (RFP—2793) **Evaluation of methods for cleaning low carbon uranium metal and alloy samples.** Kirchner, K.; Dixon, M. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 5 Jul 1979. Contract EY-76-C-04-3533. 7p. Dep. NTIS, PC A02/MF A01.

Several methods for cleaning uranium samples prior to carbon analysis, using a Leco Carbon Analyzer, were evaluated. Use of Oakite Aluminum NST Cleaner followed by water and acetone rinse was found to be the best overall technique.

SPENT FUELS REPROCESSING

REFER ALSO TO CITATION(S) 48203, 48207, 48227, 48242, 48244, 48650

48178 (DOE/ET/00944—1) **Mathematical modeling of the voloxidation process. Final report.** Stanford, T.G. (South Carolina Univ., Columbia (USA). Coll. of Engineering). Jun 1979. Contract EY-76-S-09-0944. 118p. Dep. NTIS, PC A06/MF A01.

A mathematical model of the voloxidation process, a head-end reprocessing step for the removal of volatile fission products from spent nuclear fuel, has been developed. Three types of voloxidizer operation have been considered; co-current operation in which the gas and solid streams flow in the same direction, countercurrent operation in which the gas and solid streams flow in opposite directions, and semi-batch operation in which the gas stream passes through the reactor while the solids remain in it and are processed batch wise. Because of the complexity of the physical ahd chemical processes which occur during the voloxidation process and the lack of currently available kinetic data, a global kinetic model has been adapted for this study. Test cases for each mode of operation have been simulated using representative values of the model parameters. To process 714 kgm/day of spent nuclear fuel, using an oxidizing atmosphere containing 20 mole percent oxygen, it was found that a reactor 0.7 m in diameter and 2.49 m in length would be required for both cocurrent and countercurrent modes of operation while for semibatch operation a 0.3 m^3 reactor and an 88200 sec batch processing time would be required.

48179 (KSC—1006-1) **Risk analysis of a spent fuel receiving and storage facility using the GO methodology. Final report.** Wood, D.E.; Becar, N.J. (Kaman Sciences Corp., Colorado Springs, CO (USA)). 1 Mar 1979. Contract EY-77-C-09-1006. 152p. Dep. NTIS, PC A08/MF A01.

The GO methodology has been successfully used to provide a comprehensive risk analysis of a spent fuel receiving and storage basin. As the facility was still in the conceptual design phase, the model was developed to emphasize material flows and functions rather than hardware. The multistate and interactive capability of GO was used to provide distributions of expected releases (instead of just single point values). Material flow through locations in the facility was modeled with release distributions determined for each section of the facility. Detailed risk plots are provided for some of the more significant potential releases. The expected values of the average annual potential releases from the facility are five orders of magnitude below the EPA proposed limits for the total fuel cycle of the 100 GWe of nuclear power that could be served by this facility.

48180 (LA—7797-PR) **Fission product release. Progress report, January 1—March 31, 1979.** Bryant, E.A. (comp.). (Los Alamos Scientific Lab., NM (USA)). Apr 1979. Contract W-7405-ENG-36.

19p. (ONWI/Sub—79/E511-01200-6). Dep. NTIS, PC A02/MF A01.

Leach experiments with samples of reactor fuel materal have been started. After 15 days of leaching there is a pattern of slower leaching from the fuel material in a reducing environment for all measured isotopes except ^{137}Cs. Dissolution rates of UO_2 are also are found to be slower in a hydrogen atmosphere than in an oxygen atmosphere in experiments at 70°C. Dissolution rates for ZrO_2 in the fluorite form are measured to be less than 10^{-8} g/cm²day.

48181 (ORNL/TM—6642) **Behavior of fission product iodine in the head-end reprocessing of HTGR fuel: iodine-129 studies (series 1).** Lamb, C.E.; Fitzgerald, C.L.; Vaughen, V.C.A. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 39p. AT.

The transport of ^{129}I in the head-end reprocessing of High-Temperature Gas-Cooled Reactor (HTGR) fuel was investigated using fuel removed from the Peach Bottom Reactor. This fuel consisted of TRISO-coated $(Th,U)C_2$—TRISO-coated ThC_2 microspheres in a graphite matrix. A modified grind-burn-leach flowsheet was selected to simulate the secondary burner step. To minimize the number of samples required to study the iodine behavior, the fissile and fertile fractions were crushed and processed together. Filters and suitable sorbers were positioned in the separate parts of the system for characterization purposes. Sintered Hastelloy X and high-efficiency particulate air (HEPA) absolute filters were used to remove entrained particles, whereas activated charcoal and silver-exchanged zeolite were chosen as the iodine sorbents. The fission-product data resulting from radiochemical analysis and gamma radiation measurements were compared with values predicted by the ORNL Isotope Generation and Depletion Code (ORIGEN). About 15 to 50% of the total iodine found remained with the Hastelloy X filter, and about 5 to 20% remained with the ash removed from the burner. Approximately 99% of the iodine in the gas phase leaving the burner housing was sorbed by the first activated-charcoal trap. The dissolved burner ash and insoluble residue also contained approximately 99% of the ^{144}Ce and more than 90% of the ^{134}Cs, ^{137}Cs, and ^{154}Eu.

48182 (ORNL/TM—6763) **Molten salt processes applied to ceramic fuels. First annual report, February 15, 1978—September 30, 1978.** Smith, D.H.; McDuffie, H.F. (Oak Ridge National Lab., TN (USA)). Jun 1979. Contract W-7405-ENG-26. 62p. AT.

Progress on the work package entitled Molten Salt Processes Applied to Ceramic Fuels is described, from the inception of the work package in February 1978 to the end of FY 1978. This work package is No. 10, KO of the Department of Energy's Pyrochemical and Dry Processing Methods (PDPM) program. Principal accomplishments during this period (in the order of their completion) were the following: (1) creation of a bibliography and a machine-searchable data base for the PDPM program; (2) creation of a data base for work package KO; (3) invention of the PROMEX(acronym for Proliferation Resistant Oak Ridge Molten-Salt/Metal Extraction) flow sheet for reprocessing spent nuclear fuels; (4) a critical review of the chemical and thermodynamic data on which the PROMEX is based; and (5) scouting measurements of nonextant data that are needed for the PROMEX process. Emphasis is given to how these activities validate the PROMEX flow sheet.

48183 (ORNL/TM—6775) **Evaluation of refractometry for free acid analysis in aqueous purex streams.** Bostick, D.T. (Oak Ridge National Lab., TN (USA)). May 1979. Contract W-7405-ENG-26. 35p. AT.

Refractometry has been evaluated as a possible method for determining free acid concentration in concentrated HNO_3 streams and in aqueous uranyl nitrate streams. Nitric acid can be determined with a precision of 0.2 molar units for the 0.1 to 13 M concentration range if the temperature is controlled to within 2°C. In 16 to 22 M HNO_3 streams, free acid concentration can be determined with a precision of one molar unit. The refractive index is dependent on uranium and HNO_3 concentration in uranyl nitrate streams. Uranium and excess free nitrate ion must not vary by more than 5 g/l U and 0.1 M, respectively, to obtain a 0.2 molar units precision in uranyl nitrate solutions. If the uranium concentration is unknown or varies widely, an independent uranium monitor must also be operated simultaneously with the refractometer to permit the determination of HNO_3 concentration. The temperature of the uranyl nitrate stream must also be controlled to within 2°C or a correction must be made in the refractive index measurement of the stream for a given temperature.

48184 (ORNL/TM—6817) **Diffusional model of tritium release from a size-distributed population of $(Th,U)O_2$ fuel particles.** Spencer, B.B.; Whatley, M.E. (Oak Ridge National Lab., TN (USA)). May 1979. Contract W-7405-ENG-26. 26p. AT.

Voloxidation is being developed as a process step to remove tritium from reactor fuel prior to aqueous dissolution. When the mole ratio of Th-U is greater than 4.0, $(Th,U)O_2$ fuels undergo no physical change during oxidation; therefore, they tend to release tritium by a different mechanism and more slowly than UO_2 fuels which crumble upon oxidation. A mathematical model has been developed for the release of tritium from such fuel by a simple diffusional process. Data from only one experiment were available. However, a one-parameter model, in which the diffusion coefficient was the only adjustable parameter, fit the data well. The diffusion coefficient was found to be 5.182×10^{-12} cm²/s at 600°C. This study suggests that diffusion is the controlling mechanism for tritium release; however, additional experimentation is recommended.

48185 (RFP—2928) **Process technology associated with pyrochemical reprocessing.** Baldwin, C.E.; Myles, K.M. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1979. Contract EY-76-C-04-3533. 41p. (CONF-790602—45). Dep. NTIS, PC A03/MF A01.

From ANS annual meeting; Atlanta, GA, USA (3 Jun 1979). Portions of document are illegible.

The process technology of the following three representative processes in pyrochemical reprocessing are examined in detail: melt refining, zinc distillation, and salt transport. (LK)

TRANSPORT AND STORAGE

REFER ALSO TO CITATION(S) 48179, 48225, 48227, 48228, 48229, 48230, 48231, 48238, 48996

48186 (DOE/SR/01072—1) **Intensive archeological survey of a potential independent spent fuel storage facility, Savannah River Plant, Aiken and Barnwell Counties, South Carolina. Research manuscript series 141.** Hanson, G.T.; Brooks, R.D. (South Carolina Univ., Columbia (USA). Inst. of Archeology and Anthropology). Dec 1978. Contract EW-78-S-09-1072. 88p. Dep. NTIS, PC A05/MF A01.

Purpose of this survey of the proposed ISFSF area in the SRP area was to provide a complete inventory and evaluation of the archeological resources within the 550-acre parcel. Eight previously unrecorded sites were found during the survey, with only one occurring within the main construction area. Three sites showed evidence of prehistoric occupations while the remaining sites were attributable to the historic period. Only three sites were considered to be eligible for the National Register of Historic Places. It is recommended that the construction area for ISFSF be cleared for archeological purposes and that the three eligible sites be mitigated from any adverse effects. (DLC)

48187 (EMD—79-82) **Federal facilities for storing spent nuclear fuel: are they needed.** (General Accounting Office, Washington, DC (USA)). 27 Jun 1979. 40p. General Accounting Office, 441 G Street, NW, Washington, DC.

Report to the Congress of the United States by the Comptroller General.

In late 1977, the Department of Energy announced a policy to accept and take title to spent nuclear fuel accumulating at reactor sites. The intent was to remove uncertainty facing utilities caused by storing ever increasing quantities of spent fuel indefinitely. The Department said it would need both interim and permanent spent-fuel storage facilities. GAO found that the commercial nuclear industry is technically capable of providing needed interim spent-fuel storage capacity. Options are available for both on- and off-site storage which utilities and the nuclear industry have yet to fully explore. The Department's policy to provide interim spent-fuel storage has caused uncertainties, and even delays and cancellations in industry plans to provide its own increased storage capacity. GAO concludes, therefore, that the Department should not develop an interim spent-fuel storage program. Instead, it should concentrate its efforts on getting resolution to the question of whether commercial spent fuel will be processed and how and where spent fuel will be permanently stored.

48188 (JPRS—73720, pp 1-9) **Barge for transportation of nuclear fuel described.** Ganchev, T. 19 Jun 1979. Translated from Korabostroene koraboplavane; 5-8(Mar 1979).

In Translations on Eastern Europe. Scientific Affairs, No. 633.

The design and equipment of a 1500-ton non-selfpropelled barge for the water transport of spent nuclear fuel from the Kozloduy nuclear power plant in Bulgaria to the USSR are described. (JSR)

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 48173, 48771

WASTE MANAGEMENT

REFER ALSO TO CITATION(S) 48106, 48234, 48237, 48674, 49169

48189 (DPST—77-300) **Assessment of solid low-level waste management at the Savannah River Plant.** Fenimore, J.W.; Hooker, R.L. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Aug 1977. Contract EY-76-C-09-0001. 79p. Dep. NTIS, PC A05/MF A01.

Site description, facilities, operating practices, and assessment of solid low-level waste management at the Savannah River Plant are covered. The following recommendations are made. Programs to reduce the volume of waste generated at the source should be continued. Planning to utilize volume reduction by compaction and/or incineration should be continued and adopted when practical technology is available. Utilization of grading and ditching to reduce water infiltration into trenches and to control erosion should be continued. Burial ground studies should be continued to: measure Kd's of all important radionuclides in burial ground sediments; measure hydraulic conductivities in disturbed backfill and underlying undisturbed sediments at sufficient locations to give a statistically significant sampling; and measure water flow rates better, so that individual radionuclide rates can be computed.

48190 (EPRI-NP—1087) **Nuclear waste management status and recent accomplishments. Final report.** McElroy, J.L.; Burns, R.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1979. Contract EY-76-C-06-1830. 86p. Dep. NTIS, PC A05/MF A01.

The status and technical progress of nuclear waste disposal is reviewed with emphasis on tachnical and programmatic progress in High Level Nuclear Waste disposal technology during the 1976 to 1978 time period. Process steps in the waste solidification and geologic disposal system are described emphasizing processes and systems that are more advanced in terms of readiness for full-scale U.S. demonstration. Worldwide technical accomplishments in support of the reference US waste vitrification and geologic disposal approach are highlighted.

48191 (ICP—1191) **Technical quarterly progress report, October 1—December 31, 1978.** Plung, D.L. (ed.). (Atomics International Div., Richland, WA (USA). Rockwell Hanford Operations). Apr 1979. Contract EY-76-C-07-1540. 117p. Dep. NTIS, PC A06/MF A01.

Special Materials Production: Results are reported on work done on long-term management of ICPP high-level wastes, ICPP process improvements, advanced graphite reprocessing, ICPP waste management development, technical support to the NWCF, effluent monitoring methods evaluation and development, and technical program improvement. Fuel Cycle Research and Development: Work on the fluidized-bed calcination and post-treatment of commercial waste focused on the study of bidentate compounds for separation of actinides from commercial LWR reprocessing wastes. In the krypton-85 storage development program, work concentrated on process and storage development, zeolite encapsulation, and the long-term testing of krypton storage media. Results are also reported on work done as part of the HTGR fuel reprocessing program. Other Projects Supporting Energy Development: Results from the nuclear materials security program include work on the materials control test and evaluation system, sensor and instrument development, and on the portable mass spectrometer development. Results are also reported on the in-plant source term program and on the burnup methods for FBR fuels. Research on Westinghouse Electric Corporation and Power Burst Facility fuels is reported. Work on the spectrophotometric determination of uranium in organic solvents, calculator-controlled balance weighing and volumetric titration, calculator-controlled potentiometric titrations, analysis of glass surfaces by Auger Electron Spectrometry, and OKLO studies is reported.

48192 (LA—7674-MS) **Gas generation from radiolytic attack of TRU-contaminated hydrogenous waste.** Zerwekh, A. (Los Alamos Scientific Lab., NM (USA)). Jun 1979. Contract W-7405-ENG-36. 29p. Dep. NTIS, PC A03/MF A01.

In 1970, the Waste Management and Transportation Division of the Atomic Energy Commission ordered a segregation of transuranic (TRU)-contaminated solid wastes. Those below a contamination level of 10 nCi/g could still be buried; those above had to be stored retrievably for 20 y. The possibility that alpha-radiolysis of hydrogenous materials might produce toxic, corrosive, and flammable gases in retrievably stored waste prompted an investigation of gas identities and generation rates in the laboratory and field. Typical waste mixtures were synthesized and contaminated for laboratory experiments, and drums of actual TRU-contaminated waste were instrumented for field testing. Several levels of contamination were studied, as well as pressure, temperature, and moisture effects. G (gas) values were determined for various waste matrices, and degradation products were examined.

48193 (MLM—2632) **Development of a QA program for radioactive waste containers.** Kreider, H.B. Jr. (Mound Facility, Miamisburg, OH (USA)). 20 Jul 1979. Contract EY-76-C-04-0053. 10p. Dep. NTIS, PC A02/MF A01.

The development of a quality assurance program covering the procurement of steel drums to be used for packaging radioactive waste material is presented. Problems created by the lack of, or incomplete, communication between the vendor and the buyer are discussed. The values of vendor surveys as part of the overall quality program are described. The results of this program indicate that a highly reliable quality container can be purchased at a minimal cost increase.

48194 (PNL—2727) **Safety indices and their application to nuclear waste management safety assessment.** Voss, J.W. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Apr 1979. Contract EY-76-C-06-1830. 87p. Dep. NTIS, PC A05/MF A01.

Thirteen indices have been examined to determine their potential applicability to operational waste management safety assessment. Two waste streams are presented on a normalized basis. These are the packaged spent fuel from the once-through fuel cycle and solidified high-level waste from a coprocessed UO_2—PuO_2 fuel cycle. Seven of the indices are then calculated for a hypothetical surface storage scenario of the two wastes. The indices are examined on a consistent basis to identify any biases built into them, and to determine the sensitivities of each to various waste situations. The two waste streams are then compared on the basis of the indices to extend the understanding of the analysis techniques. The results of the analysis fall into two categories, index evaluation and fuel cycle waste comparison. Only five of the indices are determined to be applicable to operational waste management safety assessment. The remainder are rejected either because they require very detailed input data; they are specifically designed for geologic isolation; they are extremely controversial in their application; or because they are particularly sensitive to a few specific radionuclides. The waste stream comparison yields three results: (1) the solidified high-level waste from the coprocessed UO_2—PuO_2 fuel cycle may be potentially less hazardous than the packaged spent fuel from the once-through fuel cycle; (2) the removal of actinides, and especially plutonium, from spent fuel may reduce the potent hazard associated with the waste; and (3) after one million years of decay, the packaged spent fuel and solidified high-level waste are nearly the same on a hazard potential basis.

48195 (SAND—79-0531(Vol.1)) **Immobilization of defense high-level waste: an assessment of technological strategies and potential regulatory goals. Volume I.** (Sandia Labs., Albuquerque, NM (USA); International Energy Associates Ltd., Washington, DC (USA)). Jun 1979. Contract EY-76-C-04-0789. 159p. Dep. NTIS, PC A08/MF A01.

An investigation was made of the high-level radioactive waste immobilization technology programs in the U.S. and Europe, and of the associated regulatory programs and waste management perspectives in the countries studied. Purpose was to assess the ability of those programs to satisfy DOE waste management needs and U.S. regulatory requirements. This volume includes: introduction, immobilization strategies in the context of waste isolation program needs, high-level waste management as an integrated system, regulatory goals, engineered-barrier characteristics, barrier technology, high-level waste disposal programs, analysis of HLW immobilization technology in the context of policy and regulatory requirements, and waste immobilization program option. (DLC)

48196 (SAND—79-0531(Vol.2)) **Immobilization of defense high-level waste: an assessment of technological strategies and potential regulatory goals. Volume II.** (International Energy Associates Ltd., Washington, DC (USA)). Jun 1979. Contract EY-76-C-04-0789. 142p. Dep. NTIS, PC A07/MF A01.

This volume contains the following appendices: selected immobilization processes, directory of selected European organizations involved in HLW management, U.S. high-level waste inventories, and selected European HLW program. (DLC)

WASTE PROCESSING

48197 (DOE/SR/01072—3) **Intensive archeological survey of a potential defense waste processing facility site, Savannah River Plant, Aiken and Barnwell Counties, South Carolina. Research manuscript series 149.** Brooks, R.D.; Hanson, G.T. (South Carolina Univ., Columbia (USA). Inst. of Archeology and Anthropology). 1979. Contract EW-78-S-09-1072. 35p. Dep. NTIS, PC A03/MF A01.

Since no archeological remains were uncovered in the proposed DWPF construction area, it is recommended that the area be cleared for archeological purposes. To assure preservation of any buried sites well beneath the present ground surface in the construction area, it is suggested that the Department of Energy arrange to have an archeologist monitor the excavation of the building sites for the DWPF. By monitoring we feel that to keep the construction progress unencumbered a process be devised by which an archeolo-

gist makes daily checks of the spoil piles for archeological material. Regarding related construction on the periphery of the main construction area (e.g. roads, powerlines, waterlines), it is recommended that the triangle formed by the roads F, 4 and E be cleared for construction of any type for archeological purposes. However, it is recommended that the Department of Energy notify the archeologists to monitor the construction for possible buried sites. Although the site 38AK261 is not considered to be significant to present or future research, it is recommended that an archeologist be notified when construction in that area is to take place in order to monitor any archeological materials uncovered.

48198 (DP-MS—78-90) **Compatibility tests of materials for a prototype ceramic melter for defense glass-waste products.** Wicks, G.G. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1979. Contract EY-76-C-09-0001. 12p. (CONF-790420—18). Dep. NTIS, PC A02/MF A01.

From International symposium on ceramics in nuclear waste management; Cincinnati, OH, USA (30 Apr 1979).

Objective is to evaluate the corrosion/erosion resistance of melter materials. Materials tested were Monofrox K3 and E, Serv, Inconel 690, Pt, and SnO. Results show that Inconel 690 is the leading electrode material and Monofrox K3 the leading refractory candidate. Melter lifetime is estimated to be 2 to 5 years for defense waste. (DLC)

48199 (DP-MS—78-97) **Operation of a pilot incinerator for solid waste.** Hootman, H.E.; Trapp, D.J.; Warren, J.H. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1979. Contract EY-76-C-09-0001. 22p. (CONF-790602—73). Dep. NTIS, PC A02/MF A01.

From ANS annual meeting; Atlanta, GA, USA (3 Jun 1979).

A laboratory-scale incinerator (0.5 kg waste/hr) was built and operated for more than 18 months as part of a program to adapt and confirm technology for incineration of Savannah River Plant solid wastes, which are contaminated with about 0.3 Ci/kg of alpha-emitting transuranium (TRU) nuclides (Slide 1). About 4000 packages of simulated nonradioactive wastes were burned, including HEPA (high-efficiency particulate air) filters, resins, and other types of solid combustible waste from plutonium finishing operations. Throughputs of more than 3 kg/hr for periods up to 4 hours were demonstrated. The incinerator was oerated at temperatures above 750°C for more than 7700 hours during a period of 12 months, for an overall availability of 88%. The incinerator was shut down three times during the year: once to replace the primary combustion chamber electrical heater, and twice to replace oxidized electrical connectors to the secondary chamber heaters. Practical experience with this pilot facility provided the design basis for the full-size (5 kg waste/hr) nonradioactive test incinerator, which began operation in March 1979.

48200 (DP-MS—78-100) **Transmutation of LWR waste actinides in thermal reactors.** Gorrell, T.C. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1979. Contract EY-76-C-09-0001. 21p. (CONF-790602—49). Dep. NTIS, PC A02/MF A01.

From ANS annual meeting; Atlanta, GA, USA (3 Jun 1979).

Recycle of actinides to a reactor for transmutation to fission products is being considered as a possible means of waste disposal. Actinide transmutation calculations were made for two irradiation options in a thermal (LWR) reactor. The cases considered were: all actinides recycled in regular uranium fuel assemblies, and transuranic actinides recycled in separate mixed oxide (MOX) assemblies. When all actinides were recycled in a uranium lattice, a reduction of 62% in the transuranic inventory was achieved after 10 recycles, compared to the inventory accumulated without recycle. When the transuranics from 2 regular uranium assemblies were combined with those recycled from a MOX assembly, the transuranic inventory was reduced 50% after 5 recycles.

48201 (ICP—1182) **Experimental mixer-settler actinide partitioning from ICPP acidic wastes.** Baker, J.D.; McIsaac, L.D.; Krupa, J.F.; Meikrantz, D.H.; Schroeder, N.C. (Allied Chemical Corp., Idaho Falls, ID (USA). Idaho Chemical Programs - Operations Office). Jun 1979. Contract EY-76-C-07-1540. 25p. Dep. NTIS, PC A02/MF A01.

Experimental mixer-settler tests were performed to demonstrate the capability and utility of DHDECMP-based solvent extraction processes for partitioning +3, +4, and +6 actinides from ICPP acidic aqueous wastes. Experiments were completed using synthetic and actual first cycle waste. A single test on actual high sodium waste is also described. These experiments show the actinide elements can be separated from ICPP acidic aqueous waste types. The resultant solutions, after calcination, would yield alpha free (< 10 nCi/g) solid waste. 3 figures, 8 tables.

48202 (MLM—2620) **Tritium waste control: October—March 1979.** Shumay, W.C. Jr. (ed.). (Mound Facility, Miamisburg, OH (USA)). 7 Jun 1979. Contract EY-76-C-04-0053. 34p. Dep. NTIS, PC A03/MF A01.

Progress is reported in the following areas: catalytic exchange detritiation studies, electrolysis of tritiated water, effect of tritium radiation on Pt—C—Teflon catalysts, gas generation measurements on tritiated waste materials, fixation of aqueous tritiated waste in polymer impregnated concrete, and management of high specific activity liquid wastes. (DLC)

48203 (ORNL/MIT—281) **Analysis of stirred-tank carbonation reactors.** Sheppard, N.F.; Rizo-Patron, R.C.; Sun, W.H. (Massachusetts Inst. of Tech., Oak Ridge, TN (USA). School of Chemical Engineering Practice; Oak Ridge National Lab., TN (USA)). 21 Nov 1978. Contract W-7405-ENG-26. 36p. Dep. NTIS, PC A03/MF A01.

The removal of CO_2 from air in a calcium hydroxide slurry-agitated reactor was investigated to aid the design of such vessels. Gas-liquid interfacial areas were calculated using theoretical rate expression and experimental data at specific operating conditions. A correlation for interfacial areas was then determined as a function of impeller speed, impeller diameter, gas flow rate, and concentration of the slurry. Decontamination factors were also determined.

WASTE DISPOSAL AND STORAGE

REFER ALSO TO CITATION(S) 48071, 48179, 48233, 48236, 48963, 49286

48204 (ANL—79-25) **ARDISC (Argonne Dispersion Code): computer programs to calculate the distribution of trace element migration in partially equilibrating media.** Strickert, R.; Friedman, A.M.; Fried, S. (Argonne National Lab., IL (USA)). Apr 1979. Contract W-31-109-ENG-38. 26p. Dep. NTIS, PC A03/MF A01.

A computer program (ARDISC, the Argonne Dispersion Code) is described which simulates the migration of nuclides in porous media and includes first order kinetic effects on the retention constants. The code allows for different absorption and desorption rates and solves the coupled migration equations by arithmetic reiterations. Input data needed are the absorption and desorption rates, equilibrium surface absorption coefficients, flow rates and volumes, and media porosities.

48205 (CONF-790822—6) **Analysis of environmental effects from disposal of solidified ICPP high-level wastes.** Chipman, N.A.; Simpson, G.G.; Lawroski, H.; Rodger, W.A.; Frendberg, R.L. (Allied Chemical Corp., Idaho Falls, ID (USA); Nuclear Safety Associates, Bethesda, MD (USA)). 1979. Contract EY-76-C-07-1570. 48p. Dep. NTIS, PC A03/MF A01.

From 87. AICHE national meeting; Boston, MA, USA (19 Aug 1979).

This work is part of a comprehensive study to assess possible environmental impacts from six different options for managing high-level defense wastes generated at the ICPP. Only radiological consequences are considered in this report; population doses to those within 80 km of ICPP were estimated for time periods up to 100 million years. The population dose to future generations from any option is insignificant compared with that from natural background radiation: less than 1 cancer death in 1,000 years compared with 20,000 cancer deaths from natural background radiation. 16 tables. (DLC)

48206 (EGG/PR/W—78-016) **Task force evaluation of TRU waste retrieval methods. Final report.** Burton, H.M.; Bills, C.W.; Fielding, J.R.; Schofield, J.S.; Warren, J.L.; Wickland, C.E.; Whitty, W.J. (Idaho National Engineering Lab., Idaho Falls (USA)). Nov 1978. Contract EY-76-C-07-1570. 96p. Dep. NTIS, PC A05/MF A01.

A task force review of the concepts for removal of buried TRU waste at INEL was performed at the request of the DOE. This task force, composed of members from outside the EG and G Waste Management Division, was selected for their particular expertise applicable to retrieval of buried TRU waste. The application of a figure-of-merit procedure to provide an orderly evaluation was selected. The conclusion of the task force was that the design concept submitted by FMC Corporation for a mechanized retrieval system has the highest potential of satisfying the requirements for safe removal of the 2.5 million ft^3 of buried waste before the year 2000 at a reasonable cost. Recommendations for further design improvements, investigative work, and studies are provided. 17 figures, 24 tables.

48207 (ICP—1195) **Removal and disposal of radioactive sludge from the fuel storage basin at the Idaho Chemical Processing Plant.** Hoech, G.W.; Rhodes, D.W. (Allied Chemical Corp., Idaho Falls, ID (USA). Idaho Chemical Programs - Operations Office). Jun 1979. Contract EY-76-C-07-1540. 27p. Dep. NTIS, PC A03/MF A01.

The fuel storage basin at the Idaho Chemical Processing Plant recently underwent an intensive cleanup program. A major part of

this program consisted of removing a five-to-ten cm layer of sludge from the basin floor and a lesser amount from the walls. The techniques used to vacuum this sludge into a large storage tank and then transfer if from the storage tank to portable concrete storage vaults where it was solidified are described. The equipment used is also described in detail. Approximately 48,150 liters of sludge was removed and solidified for disposal at the Radioactive Waste Management Complex.

48208 (LA—7775-PR) **Studies of transuranic waste storage under conditions expected in the Waste Isolation Pilot Plant (WIPP). Progress report, December 15, 1978—March 15, 1979.** Kosiewicz, S.T.; Barraclough, B.L.; Zerwekh, A. (Los Alamos Scientific Lab., NM (USA)). May 1979. Contract W-7405-ENG-36. 22p. Dep. NTIS, PC A02/MF A01.

Thermal decomposition of waste matrices currently appears to be less important than previously reported. Low dose-rate experiments (4×10^5 nCi/g) are generating some gas, but not enough to permit quantification of the gas evolution rates. Some catalyzed thermal degradation may be occurring for polyethylene and cellulosics. The low-temperature and the low dose-rate experiments require additional prolonged exposure time because their gas evolution rates are so low. These experiments simulate most closely the conditions that real wastes would experience. WIPP lithostatic pressure (1.5×10^4 kPa) on the solid waste is estimated to generate gas at 10 to 300% of the rate of similar but nonpressurized experiments. Experiments that are prepressurized to 1×10^4 kPa deuterium show a decrease of 50 to 60% in the rate of hydrogen evolution. Self-pressurization up to 830 kPa by radiolytically evolved gases does not change the rate of additional gas production. Current data appear to indicate that radiolytic gas evolution rates may be dose-rate dependent. The rates of gas evolution by radiolysis are temperature dependent, but the magnitude of the effect diminishes with time. G(gas) for polyvinyl chloride is tentatively estimated to be 8 to 11 gas molecules per 100 eV. Thermogravimetric analyses of bitumen in air and nitrogen are reported. Additionally, the assessment and detailed characterization of the LASL TRU waste inventory has been completed and final data are presented. 6 figures, 9 tables.

48209 (LA—7788-PR) **Potential microbial impact on transuranic wastes under conditions expected in the Waste Isolation Pilot Plant (WIPP). Progress report, October 1—December 15, 1978.** Barnhart, B.J.; Campbell, E.W.; Hardin, J.M.; Martinez, E.; Caldwell, D.E.; Hallett, R. (Los Alamos Scientific Lab., NM (USA)). May 1979. Contract W-7405-ENG-36. 21p. Dep. NTIS, PC A02/MF A01.

Since October 1, microorganisms were successfully enumerated in soil from an area adjacent to a shallow burial site (Area C) at the Los Alamos Scientific Laboratory. From 1.33 to 2.98×10^6 aerobic colony forming units (CFU) were found per gram of soil as compared with $1.99 \times 2.97 \times 10^3$ anaerobic CFU per gram. The fungus population ranged from 3.5×10^3 to 3.2×10^4 CFU per gram. The most probable number (MPN) demonstrated in nutrient broth by the extinction dilution method was similar for aerobic and anaerobic bacteria. Direct counting of microflora in fluorescent-stained soil samples has been initiated using the epifluorescent microscopy capability at the University of New Mexico. It was demonstrated the almost quantitative methylation of mercury and attempts were made to alkylate europium in an abiotic reaction with methylcobalamine, a metabolic intermediate in bacterial metabolism, but methylation was not detected over a range of pH (4.0 to 7.0) and at two temperatures (25°C and 37°C). The alkylation of thorium is being pursued as a prerequisite to working with plutonium. Studies of europium citrate and europium EDTA chelate degradation have begun. Both degrade, but EDTA degrades at a much slower rate than citrate. Methodology has been improved in preparation for analogous studies of plutonium chelate degradation. The microbial production of gases under conditions expected for the WIPP has been studied. Carbon dioxide is the only significant gas detected. Hydrogen sulfide is also produced if a high concentration of proteinaceous substrate is present.

48210 (LA-UR—79-1039) **Shallow land burial: experience and developments at Oak Ridge and Los Alamos.** Warren, J.L. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 35p. (CONF-790711—1). Dep. NTIS, PC A03/MF A01.

From International symposium on underground disposal of radioactive wastes; Otaniemi, Finland (2 Jul 1979).

Since the mid-1940's, in excess of 250,000 m^3 of low- and intermediate-level radioactive solid waste, generated in operations at the Los Alamos Scientific Laboratory (LASL), has been disposed of by on-site shallow land burial and retrievable storage in dry volcanic tuff. Guidelines have been developed at LASL which regulate the construction of waste disposal facilities, burial and storage operations, disposal site maintenance and restoration, and documentation of all waste disposal activities. Monitoring programs at the past and current solid waste disposal sites have continued to show that, with the exception of low levels of tritium, no migration of contaminants away from their disposal location has been detected.

48211 (LBL—8570) **Rock mass characterization for storage of nuclear waste in granite.** Witherspoon, P.A.; Nelson, P.; Doe, T.; Thorpe, R.; Paulsson, B.; Gale, J.; Forster, C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; Waterloo Univ., Ontario (Canada). Dept. of Earth Sciences). Feb 1979. Contract W-7405-ENG-48. 39p. (SAC—18). Dep. NTIS, PC A03/MF A01.

The rock mass characterization in granite adjacent to an iron mine at Stripa, Sweden is being carried out by four different methods. The mechanical characterization includes monitoring the responses to thermal loading of jointed rock in situ, and mechanical tests on cores from 25 mm to 1 m in diameter. Geological characterization includes detailed surface mapping, subsurface mapping, and core mapping. Geophysical characterization uses a variety of borehole techniques, with emphasis on sonic methods. The hydrologic characterization is done through injection tests, pump tests, water pressure measurements, and controlled inflow tests to tunnels. Since the data are not yet complete, only tentative conclusions can be drawn regarding the best combinations of techniques for rock-mass characterization. Mapping studies are useful in defining continuity and fracture-system geometry. They do not give aperture, a factor significant in terms of both water flow and the displacements due to heating. Of the geophysical techniques, sonic methods appear most effective in fracture definition; other methods, gamma and neutron particularly, give data on radionuclide and water content and need further analysis with geologic and hydrologic data to determine their significance. Hydrologic work yields primarily aperture data, which with fracture geometry can be used to calculate directional permeabilities. Pressure measurements may provide one means of assessing fracture continuity. Finally, laboratory tests on large cores suggest considerable refinement in testing techniques may be needed before stress-aperture data can be extrapolated from laboratory to field. (LK)

48212 (NUREG/CR—0707) **Evaluation of isotope migration, land burial. Water chemistry at commercially operated low-level radioactive waste disposal sites. Progress report No. 9, April—June 1978.** Colombo, P.; Weiss, A.J. (Brookhaven National Lab., Upton, NY (USA)). Feb 1979. Contract EY-76-C-02-0016. 35p. (BNL-NUREG—50965). Dep. NTIS, PC A03/MF A01.

This report describes equipment and procedures developed for measuring the sorption distribution coefficient, K/sub d/, of selected radionuclides using site specific soils and trench waters from low-level radioactive waste disposal sites. Batch experiments were conducted under anoxic and oxic conditions with soil and trench water from the West Valley, New York, disposal site. Variations in K/sub d/ as a result of changes in pH, aeration, and water to soil ratio are reported. 17 figures, 6 tables.

48213 (ORNL—5526) **Effects of temperature, temperature gradients, stress, and irradiation on migration of brine inclusions in a salt repository.** Jenks, G.H. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 73p. Dep. NTIS, PC A04/MF A01.

Available experimental and theoretical information on brine migration in bedded salt are reviewed and analyzed. The effects of temperature, thermal gradients, stress, irradiation, and pressure in a salt repository are among the factors considered The theoretical and experimental (with KCl) results of Anthony and Cline were used to correlate and explain the available data for rates of brine migration at temperatures up to 250°C in naturally occurring crystals of bedded salt from Lyons and Hutchinson, Kansas. Considerations of the effects of stressing crystals of bedded salt on the migratin properties of brine inclusions within the crystals led to the conclusion that the most probable effects are a small fractional increase in the solubility of the salt within the liquid and a concomitant and equal fractional increase in the rate of the thermal gradient-induced migration of the brine. The greatest uncertainty relative to the prediction of rates of migration of brine into a waste emplacement cavity in bedded salt is associated with questions concerning the effects of the grain boundaries (within the aggregates of single crystals which comprise a bedded salt deposit) on brine migration through the deposit. The results of some of the estimates of rates and total amounts of brine inflow to HLW and SURF waste packages emplaced in bedded salt were included to illustrate the inflow volumes which might occur in a repository. The results of the brine inflow estimates for 10-year-old HLW emplaced at 150 kW/acre indicated inflow rates starting at 0.7 liter/year and totaling 12 liters at 30 years after emplacement. The results of the estimates for 10-year-old PWR SURF emplaced at 60 kW/acre indicated a constant inflow of 0.035 liter/year for the first 35 years after emplacement.

48214 (PNL—2918) **Biobarriers used in shallow-burial ground stabilization.** Cline, J.F. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Mar 1979. Contract EY-76-C-06-1830. 24p. Dep. NTIS, PC A02/MF A01.

These data show that cobblestone can be effective as a barrier to burrowing animals and insects, but not totally effective as a barrier to plant roots. Because of variable weather patterns at Hanford, five to six year studies are recommended for further

evaluation of the effectiveness of different materials as biobarriers to radioactive substances. The following criteria must be met to present plant roots from entering buried waste and transporting radioactive or other elements to the soil surface where they can enter the food web: (1) the burial zone beneath the cover should be kept dry; (2) enough soil or other water-retaining substance should be placed in the cover to hold annual precipitation; (3) plants or other substances should be placed in the cover to remove soil moisture from site each year via evaporation and plant transpiration; and (4) different additions to the cover should be designed and placed over the buried waste to prevent burrowing animals from causing channelization of water through the cover to the lower levels. Stone size appeared to affect the plants' rate of root growth since root growth slowed in the air spaces between stones. Root toxin was 100% effective as a means of keeping roots out of the buried waste; this method could be used as a barrier modification where no plant cover is needed. 9 figures, 2 tables.

48215 (RHO-BWI-LD—20) **Preliminary description of hydrologic characteristics and contaminant transport potential of rocks in the Pasco Basin, south-central Washington.** Deju, R.A.; Fecht, K.R. (Atomics International Div., Richland, WA (USA). Rockwell Hanford Operations). Mar 1979. Contract EY-77-C-06-1030. 142p. Dep. NTIS, PC A07/MF A01.

This report aims at consolidating existing data useful in defining the hydrologic characteristics of the Pasco Basin within south-central Washington. It also aims at compiling the properties required to evaluate contaminant transport potential within individual subsurface strata in this basin. The Pasco Basin itself is a tract of semi-arid land covering about 2,000 square miles in south-central Washington. The regional geology of this basin is dominated by tholeiitic flood basalts of the Columbia Plateau. The surface hydrology of the basin is dominated by the Yakima, Snake, and Columbia rivers. Short-lived ephemeral streams may flow for a short period of time after a heavy rainfall or snowmelt. The subsurface hydrology of the Pasco Basin is characterized by an unconfined aquifer carrying the bulk of the water discharged within the basin. This aquifer overlies a series of confined aquifers carrying progressively smaller amounts of groundwater as a function of depth. The hydraulic properties of the various aquifers and non-water-bearing strata are characterized and reported. A summary of the basic properties is tabulated. The hydrochemical data obtained are summarized. The contaminant transport properties of the rocks in the Pasco Basin are analyzed with emphasis on the dispersion and sorption coefficients and the characteristics of the potential reactions between emplaced waste and the surrounding medium. Some basic modeling considerations of the hydrogeologic systems in the basin with a brief discussion of model input requirements and their relationship to available data are presented.

48216 (RHO-CD—27-3Q) **Summary of radioactive solid waste burials in the 200 areas during the first three quarters of 1977.** Anderson, J.D.; Poremba, B.E. (Atomics International Div., Richland, WA (USA). Rockwell Hanford Operations). 7 Dec 1977. Contract EY-76-C-14-2170. 44p. Dep. NTIS, PC A03/MF A01.

In addition to data for the first three quarters of 1977, cumulative data since plant startup are presented, along with a listing of decayed activity to the various plant burial sites. (DLC)

48217 (RHO-LD—78-24-2Q) **Summary of radioactive solid waste burials in the 200 areas during the first half of 1978.** Anderson, J.D.; Poremba, B.E. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 28 Aug 1978. Contract EY-77-C-06-1030. 41p. Dep. NTIS, PC A03/MF A01.

In addition to date for 1978, cumulative data since plant startup are presented. Also in this document is a listing of decayed activity to the various plant burial sites.

48218 (RHO-LD—78-24-3Q) **Summary of radioactive solid waste burials in the 200 areas during the first three quarters of 1978.** Anderson, J.D.; Poremba, B.E. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 13 Dec 1978. Contract EY-77-C-06-1030. 44p. Dep. NTIS, PC A03/MF A01.

In addition to data for 1978, cumulative data since plant startup are presented. Also in this document is a listing of decayed activity to the various plant burial sites.

48219 (RHO-LD—78-24-4Q) **Summary of radioactive solid waste burials in the 200 areas during 1978.** Anderson, J.D.; Poremba, B.E. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 12 Mar 1979. Contract EY-77-C-06-1030. 48p. Dep. NTIS, PC A03/MF A01.

In addition to data for 1978, cumulative data since plant startup is presented. Also in this document is a listing of decayed activity to the various plant burials sites.

48220 (RHO-SA—99) **Evaluation of a decommissioned radwaste pond.** Paine, D.; Price, K.R.; Mitchell, R.M. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Feb 1979. Contract EY-77-C-06-1030. 19p. (CONF-790209—8). Dep. NTIS, PC A02/MF A01.

From 12. Health Physics Society midyear topical symposium; Williamsburg, VA, USA (12 Feb 1979).

An eight hectare radwaste pond (216-S-17) which received cooling water effluent from a nuclear fuel reprocessing plant at Hanford from 1951 to 1954 was contaminated due to unplanned releases. Subsequently, it was decommissioned by covering the area with 45 to 60 cm of backfill. Soil erosion and nuisance contamination, in the form of tumbleweeds (Salsola kali), occurred between 1954 and 1972 due to the lack of a specific revegetation program. Siberian Wheatgrass (Agropyron sibericum) and Cereal Rye (Secale cereale) were planted in 1972 and allowed to grow under conditions. A routine evaluation of the site disclosed the presence of contaminated Siberian Wheatgrass plants. This report describes the results of a radioecological study of the site in 1978. Nondestructive methods developed for in-situ evaluation to determine radionuclide inventories and transport parameters for biotic and abiotic compartments are presented concomitant with standard procedures. Results indicate that Siberian Wheatgrass is a suitable perennial for revegetation of low-level waste disposal sites in an arid environment.

48221 (SAND—79-0789) **Borehole Plugging Program. Plugging of ERDA No. 10 drill hole.** Gulick, C.W. Jr. (Sandia Labs., Albuquerque, NM (USA)). Jun 1979. Contract EY-76-C-04-0789. 24p. Dep. NTIS, PC A02/MF A01.

A requirement exists to plug exploratory drill holes located in the proposed Waste Isolation Pilot Plant area of Southeastern New Mexico. Sandia Laboratories, in cooperation with the US Army Corps of Engineers, Waterways Experiment Station, Concrete Laboratory, developed pumpable and durable cement grouts. These grouts were successfully used to plug an existing drill hole in the area. Results of this project are presented, along with comments and conclusions.

48222 (SAND—79-1117C) **Technical issues of nuclear waste isolation in the Waste Isolation Pilot Plant (WIPP).** Hunter, T.O. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 22p. (CONF-790822—4). Dep. NTIS, PC A02/MF A01.

From 87. AICHE national meeting; Boston, MA, USA (19 Aug 1979).

The development of the Waste Isolation Pilot Plant is supported by a research and development program which addresses various technical issues for geologic isolation of nuclear waste in bedded salt. These issues include waste interaction with the host material, structural response of the rock, repository sealing, and methods for repository design and operation. This paper discusses the status of various laboratory and field investigations in this program, and presents a summary of recent results for selected issues. In addition, an overview of all activities and the relations of each to plans for implementation of WIPP is presented. These plans include full-scale experimentation with various waste forms in 1986.

48223 (SAND—79-1275C) **Model development for in situ test results in argillaceous rock.** Tyler, L.D. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 23p. (CONF-790683—1). Dep. NTIS, PC A02/MF A01.

From ONWI-LLL workshop on thermomechanical modeling for a hard rock repository; Berkeley, CA, USA (25 Jun 1979).

Near-surface heater tests have been conducted in two different geologic settings for argillaceous rocks. The results of these tests have provided the in situ data necessary to develop the thermomechanical models for predicting the response of argillaceous rock to thermal load representative of high-level nuclear waste.

48224 (UCRL—13766(Vol.2)) **Aspects of nuclear waste management. Volume 2: post-emplacement hazards.** Ross, B.I.; Berman, L.E.; Hough, M.E.; Pollak, G.D. (Analytic Sciences Corp., Reading, MA (USA)). 10 Apr 1979. Contract W-7405-ENG-48. 159p. Dep. NTIS, PC A08/MF A01.

Studies of technical issues relating to nuclear waste management are described. It supplements previous TASC reports on this topic. Volume 1 addresses events occurring before emplacement of the waste in a repository. The subjects addressed are thermal analysis of interim storage accidents and doses to the worst-situated individual in all types of pre-emplacement accidents. Volume 2 deals with the possible release of waste from a geologic repository. Aspects of long-term repository performance which are discussed include water flow around shafts and boreholes and use of water from contaminated wells. New methods and results pertaining to the analysis of uncertainties in long-term risk predictions are also presented.

48225 (UCRL—81992) **Thermal-stress analysis of rock formations for nuclear fuel and waste storage.** Greenlaw, R.C.; Gerhard, M.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Jun 1979. Contract W-7405-ENG-48. 28p. (CONF-790827—2). Dep. NTIS, PC A03/MF A01.

From ADINA conference; Cambridge, MA, USA (1 Aug 1979).

ADINA and ADINAT in partnership have provided a unique tool for analysis of heat flow, temperature distribution, and underground stresses and deformations due to excavation and storage of nuclear fuel and/or waste cannisters in hard rock formations. During this work we have determined successful and unsuccessful combinations of elements and properties for both the thermal and the stress analyses. In addition, we have determined a need for thermal radiation transport between portions of the model, as contrasted to radiation between the model and its surroundings. This latter need has been met in the interim by use of nonlinear bar conductors, and it will be satisfied in the future by a special user subroutine at ADINAT. The geological modeling was preceeded by a period of code testing and verification during which it was found that at least one material model did not produce correct thermal stresses even though the thermal deformations were correct. We also found that thermal stresses were likely to be in apparent error due to differences in the way in which ADINA interpolates the temperature and strain fields within each element. Solutions to this problem are discussed.

48226 (RHO-LD—78-24-4Q(Rev.1)) **Summary of radioactive solid waste burials in the 200 areas during 1978.** Anderson, J.D.; Poremba, B.E. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 21 May 1979. Contract EY-77-C-06-1030. 48p. Dep. NTIS, PC A03/MF A01.

This document summarizes quarterly the amount of radioactive materials that have been buried in the burial grounds. In addition to data for 1978, cumulative data since plant startup is presented. Also in this document is a listing of decayed activity to the various plant burial sites.

48227 Spent fuel policy and its implications. Executive conference proceedings. La Grange Park, IL; American Nuclear Society (Apr 1978). vp. (CONF-7804136—).

From Conference on spent fuel policy and its implications; Buford, GA, USA (2 Apr 1978).

Various aspects of the spent fuel storage and disposal problem are presented. The views of the DOE, the Congress, and the utilities concerning the 1977 moratorium on fuel reprocessing with attendent necessity for spent fuel storage are presented. Spent fuel storage experiences in both the US and Canada are discussed. Various economic facets of the situation are also discussed. Separate abstracts have been prepared for 22 papers.

48228 Federal perspective on spent fuel policy. Beckjord, E.S. (Department of Energy, Washington, DC). pp 11p, Paper 2 of Spent fuel policy and its implications. Executive conference proceedings. La Grange Park, IL; American Nuclear Society (Apr 1978).

From Conference on spent fuel policy and its implications; Buford, GA, USA (2 Apr 1978).

The projected policy of DOE to provide both interim away-from-reactor (AFR) and permanent storage for spent reactor fuel as a counterpoint to the President's announcement on April 7, 1977, of the indefinite moratorium on fuel reprocessing is again outlined. The responses of various sectors of the industry to the projected need for such facilities as to date, capacity, and probability of use are outlined. It is pointed out that all factors influence each other from the industry point of view; however, DOE plans need to be firm before industry can make a commitment to use the proposed facilities. Ways of determining costs to user of the storage facilities are explored, and the progress on both foreign and domestic Generic Environmental Impact Statements is reported.

48229 Experience in operation of the Morris Operation storage facility. Voiland, E.E. (General Electric Co., Morris, IL). pp 6p, Paper 12 of Spent fuel policy and its implications. Executive conference proceedings. La Grange Park, IL; American Nuclear Society (Apr 1978).

From Conference on spent fuel policy and its implications; Buford, GA, USA (2 Apr 1978).

The results of six years experience in receiving and storing spent fuel at the facilities of General Electric's Morris Operations in northeastern Illinois are described. The fuel is stored in water pools; and the conclusion is drawn that storage in this facility for this period of time has resulted in little risk to the public. It is projected that storage for periods of up to 40 years in demineralized water without damage to the fuel or risk of catastropy is a conservative projection.

48230 DOE implementation and management of the US spent fuel policy. Lawrence, M.J. (Department of Energy, Washington, DC). pp 17p, Paper 19 of Spent fuel policy and its implications. Executive conference proceedings. La Grange Park, IL; American Nuclear Society (Apr 1978).

From Conference on spent fuel policy and its implications; Buford, GA, USA (2 Apr 1978).

In relation to the development of the one-time storage/disposal charge in the Spent Fuel Policy, preliminary cost and fee data developed by the Spent Fuel Program of the Nuclear Power Development Division are presented. The calculations are based on certain assumptions that may not necessarily hold true at the time of operation of a spent fuel storage facility in 1983, 1985, or 2000. The costs of facilities were grouped into the following six categories or cost centers: (1) away-from-reactor storage facility, (2) geologic repository, (3) encapsulation facility, (4) transportation, (5) research and development, and (6) government overhead. A time factor to the year 2000, a single charge covering both storage and/or disposal, and a contingency of 30% were all assumptions for the calculations. A resulting charge of ~ $140/kg or 0.5 mills/kWh was calculated. A review of certain of the assumptions led to a sensitivity analysis in which 22 cases were examined. This analysis resulted in a calculated charge in the range of $70 to $270/kg.

48231 Utility perspective on the cost and scheduling of spent fuel storage facilities. Hanson, A.S. (Yankee Atomic Electric Co., Westboro, MA). pp 22p, Paper 20 of Spent fuel policy and its implications. Executive conference proceedings. La Grange Park, IL; American Nuclear Society (Apr 1978).

From Conference on spent fuel policy and its implications; Buford, GA, USA (2 Apr 1978).

The DOE spent fuel policy is reviewed from the utilities standpoint. Response was received from 14 firms mainly concerning operation of a storage facility as a subcontractor for the DOE, and those firms willing to build a facility either sought Federal guarantees on the investment of completely ignored financing. Utilities are apparently very interested in spent fuel storage as outlined by the DOE. However, the author points out that there is a real doubt as to the time of availability of the DOE storage, and alternatives available to the utilities for fuel storage are explored. These consist of modification of existing storage basins, shipment of fuel to a different storage basin, or construction of a new storage facility either at the reactor site or off the original reactor site. All utilities are encouraged to support the government spent fuel policy but not to rely solely on the Federal government for fuel storage if it is needed before the late 1980's. Contingency fuel storage plans should be developed.

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 48212, 48220, 49146, 49162, 49166, 49167

48232 (DOE/EDP—0061) **Environmental Development Plan for advanced isotope separation.** (Department of Energy, Washington, DC (USA)). May 1979. 94p. Dep. NTIS, PC A05/MF A01.

This EDP identifies the planning and management requirements and schedules needed to evaluate and assess the environmental, health, and safety aspects of the Advanced Isotope Separation (AIS) program. Current AIS processes include the molecular and atomic vapor laser processes and the plasma process. This document covers the technology program, environmental concerns and requirements, and environmental strategy. (DLC)

48233 (NUREG/CR—0842) **Characteristics of wastes and soils which affect transport of radionuclides through the soil and their relationship to waste management. Annual report FY78.** Polzer, W.L.; Fowler, E.B.; Essington, E.H. (Los Alamos Scientific Lab., NM (USA)). Apr 1979. Contract W-7405-ENG-36. 79p. (LA-UR—79-1025). Dep. NTIS, PC A05/MF A01.

Soil samples were collected from Beatty, NV, the University of California, Los Angeles/University of California, Berkeley (UCLA/UCB) project, California and Nebraska. Results of waste/soil interaction studies indicate that waste radionuclides can be categorized into three broad forms; filterable (insoluble) and sorbable and nonsorbable (soluble). The relative distribution of the three depends on the storage time of the waste and on the soil which is interacted with the waste. In the filterable (insoluble) fraction the radionuclides are associated with both organic and inorganic particulates. The primary inorganic particulate was identified as calcium carbonate. The soluble nonsorbable waste radionuclides possess a negative charge with the exception of ^{137}Cs; that species is positively charged. The presence of negatively charged species is attributed to complexing with either carbonate or chelating compounds. Changes in the soluble fraction of waste radionuclides on storage of waste are attributed in part to the dissolution or precipitation of calcium carbonate and perhaps the degradation of organic material or growth of microorganisms in the waste. 11 figures, 31 tables.

48234 (TREE—1357) **Environmental surveillance report for the INEL Radioactive Waste Management Complex. Annual Report: 1978.** Adams, L.E.; Janke, D.H.; Dickman, P.T. (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1979. Contract EY-76-C-07-1570. 57p. Dep. NTIS, PC A04/MF A01.

This document is the 1978 annual environmental surveillance report for the Radioactive Waste Management Complex (RWMC)

of the Idaho National Engineering Laboratory. Included are tabulated data from and discussions about routine radiological monitoring of atmospheric, hydrologic, geologic, and biotic environments of the RWMC. In addition, descriptions of six special studies and projects presently being planned, developed, or implemented are included. It is concluded that: (a) RWMC operations have not adversely effected local, existing environments; (b) environmental conditions within the Transuranic Storage Area are not corrosive enough to adversely effect transuranic waste storage containers; and (c) the addition of lake bed soil to pit, trench, and soil test plot areas has altered the moisture cycle characteristic of RWMC soil.

48235 EIS for uranium mining operation on Indian lands ruled adequate. Stephenson, B. *Nat. Resour. J.;* **18**: No. 2, 397-401(Apr 1978).

Environmental Law: EIS for uranium exploration and mining lease on Indian land was found to be adequate if it acknowledges possible detrimental effects, although no method or plan to control such effects is discussed. Tribe is a necessary but not indispensable party to such suit. Manygoats v. Kleppe, 558 F.2d 556 (10th Cir. 1977).

48236 Uranium mill tailngs: the problem of disposal with a special look at New Mexico. Wayland, S.M. *Nat. Resour. J.;* **18**: No. 2, 431-448(Apr 1978).

A properly done GEIS should provide a good definition of the problem. A joint research program should be established between EPA and NRC. Both have information in the area; a joint effort should keep them from wrangling over jurisdictional problems. The study should establish: 1) the risks involved as measured at real sites; 2) what can be expected to happen at these locations in the future; 3) the best corrective measures to avoid the risks. Joint EPA—NRC regulations should require the research results to be implemented appropriately; any final solution should be objective, with the general public's interest considered first. The time for public advocacy is after the research is completed. Once the problems are defined in a satisfactory manner, an adequate bonding program should be established to prevent future recurrences of the tailings problems.

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 48204, 48205, 48224, 48232, 49142, 49146, 49167

48237 (CONF-790209—7) **Radiological impact of uranium tailings and alternatives for their management.** Momeni, M.H.; Kisieleski, W.E.; Tyler, S.; Zielen, A.; Yuan, Y.; Roberts, C.J. (Argonne National Lab., IL (USA)). 1979. Contract W-31-109-ENG-38. 24p. Dep. NTIS, PC A02/MF A01.

From 12. Health Physics Society midyear topical symposium; Williamsburg, VA, USA (12 Feb 1979).

Uncontrolled tailings piles are mobile sources of fugitive dust that may produce a practically uncleanable adjacent environment. A practical procedure for managing solid tailings is addition of surface moisture, mechanical and gravitational separation of slimes, and storage of slimes below solution tailings. Presently practical alternatives for tailings management are variations of two basic methods - surface below-ground disposal. Isolation of tailings by natural materials such as clay lenses and combinations of overburden, top soil, vegetation and rip-rap may provide both minimization of exposure and stability. Experimental measurement of radon flux over two inactive tailings, acid and carbonate leached tailings resulted in average specific flux values of phi $\propto \cong 0.64$ and phi $\propto \cong 0.30$ (pCi Rn-222/m^2 sec) / (pCi Ra-226/g), respectively. The average diffusion coefficient for these tailings were, respectively, 2.4×10^{-3} and 5.7×10^{-4} cm^2/sec. Tailings covered with native soil of clay-silt-sand mixture to a depth of 225 cm resulted in attenuation of flux with diffusion coefficients of 3.69×10^{-3} and 3.60×10^{-3} cm^2/sec for ACID and ALKO sites, respectively. By means of the UDAD code dose commitments were estimated for inhalation of particulates and radon and for external exposure under three degrees of surface moisture on the tailings. Based on these analyses and assumption that the dose contribution from ingestion pathway is comparable in magnitude to that of inhalation, both compliance with the 25 mrem/year limit and reduction of flux to background level is feasible. Stability of alternative decommissioned tailings over the predictable future is discussed.

48238 (NUREG/CR—0811) **Scoping study of spent fuel cask transportation accidents.** Rhyne, W.R.; Ritzman, R.L.; Cothran, H.E. Jr.; Allgeier, J.P.; Barton, C.J. Sr. (Science Applications, Inc., Oak Ridge, TN (USA)). Jun 1979. 144p. (SAI-OR—79-140-04). NTIS, PC A07/MF A01.

A scoping study of spent fuel cask transportation accidents was performed to provide the NRC with an assessment of existing information and to recommend, on a priority basis, the additional information that should be obtained to allow specification of increasingly realistic source terms. The scope was limited to the escape of radionuclides from the cask to the environment resulting from severe accidents. The accident environment definition associated with a severe accident is the starting point and was selected not for its realism but to allow sensitivity studies on the remaining variables in the accident scenario. However, given this accident definition, the remainder of the evaluation of the accident scenarios is to be as realistic as possible. Information was found to be inadequate to make correlations between accident severity and radionuclide release. Generally, cask and fuel rod thermal-hydraulic data and analytical capability were found to be reasonably adequate; however, data and analytical capability for evaluating structural response to impact are not. Radionuclide behavior information is adequate for noble gases but generally inadequate for most volatile radionuclides and for fuel particulates. A series of gauging calculations were performed to permit prioritization of the information needs, and research recommendations were made in eight areas.

REGULATIONS

ACCOUNTABILITY AND SAFEGUARDS

REFER ALSO TO CITATION(S) 48182, 48957

48239 (CONF-790707—8) **Nondestructive assay of subassemblies of various spent or fresh fuels by active neutron interrogation.** Ragan, G.L.; Ricker, C.W.; Chiles, M.M.; Ingersoll, D.T.; Slaughter, G.G. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 11p. Dep. NTIS, PC A02/MF A01.

From 20. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (16 Jul 1979).

Recent studies show that subassemblies containing various spent fuels could be assayed rapidly and accurately by a nondestructive assay system using active neutron interrogation and prompt-neutron detection. Subassembly penetration is achieved by 24-keV (Sb—Be) interrogation neutrons; the spent-fuel neutron background is overridden by using strong interrogating sources and prompt-neutron signals, and background gammas are absorbed by lead. Experiments have demonstrated the potential for assaying with better than 5% accuracy, three spent plutonium-fueled subassemblies per hour. Calculations, validated by experiments, predict even better performance for fresh or uranium-fueled subassemblies; several performance estimates are given.

48240 (LA—7730-MS) **Preliminary concepts: safeguards for spent light-water reactor fuels.** Cobb, D.D.; Dayem, H.A.; Dietz, R.J. (Los Alamos Scientific Lab., NM (USA)). Jun 1979. Contract W-7405-ENG-36. 31p. Dep. NTIS, PC A03/MF A01.

The technology available for safeguarding spent nuclear fuels from light-water power reactors is reviewed, and preliminary concepts for a spent-fuel safeguards system are presented. Essential elements of a spent-fuel safeguards system are infrequent on-site inspections, containment and surveillance systems to assure the integrity of stored fuel between inspections, and nondestructive measurements of the fuel assemblies. Key safeguards research and development activities necessary to implement such a system are identified. These activities include the development of tamper-indicating fuel-assembly identification systems and the design and development of nondestructive spent-fuel measurement systems.

48241 (LA-UR—79-789) **Measurement control program for in-line NDA instruments.** Severe, W.R.; Thomas, C.C. Jr. (Los Alamos Scientific Lab., NM (USA)). Jul 1979. Contract W-7405-ENG-36. 4p. (CONF-790707—4). Dep. NTIS, PC A02/MF A01.

From 20. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (16 Jul 1979).

A measurement control program has been developed for the nondestructive assay (NDA) used in the Los Alamos Dynamic Material Control (DYMAC) system. The NDA instruments range in complexity from digital electronic balances to minicomputer based neutron and gamma-ray assay systems. The measurement control program serves two major functions. The first provides on-line checks of instrument accuracy and precision. The second function provides the data base necessary for defining and monitoring the systematic and random errors associated with individual instruments. The mathematical aspects of the measurement control program are presented and several specific examples of results discussed.

48242 (PB—291192) **Methods for the accountability of reprocessing plant dissolver and waste solutions. Technical report.** Stephens, F.B.; Gutmacher, R.G.; Ernst, K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Dec 1978. 133p. NTIS PC A07/MF A01.

This publication provides guidance on methods and procedures for the accountability of reprocessing plant dissolver and waste solutions. Adherence to the recommendations detailed therein

will enable the user to control these materials to a degree consistent with recent measurement capability. The scope of this publication is limited to chemical and/or destructive analytical techniques and omits methods of non-destructive analysis. This document details methods for the accountability of the total plutonium, the total fissile plutonium (Pu and Pu), the total uranium and the total fissile uranium (U) in solutions resulting from the reprocessing of spent light water reactor fuel. It is concerned only with the input dissolver solution (accountability tank), the residual uranium and plutonium in the leached hulls, and the waste streams in the separation process. Methods for the accountability of products of the reprocessing plant have been given in previously issued manuals.

48243 (SAND—79-1196C) **Impact of certain safeguards considerations on fuel-cycle facility design.** Darby, J.L.; de Montmollin, J.M. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 15p. (CONF-790602—68). Dep. NTIS, PC A02/MF A01.

From ANS annual meeting; Atlanta, GA, USA (3 Jun 1979).

Both physical protection and containment/surveillance systems impact plant design and operations. Effective physical protection systems can be systematically designed; work on designing containment/surveillance systems is in progress. Fuel fabrication facility designers need to be cognizant of these safeguards system developments to enable effective implementation of them with as little effect on plant functions as possible. This brief overview provides a general indication of what the impacts of the systems might be, and current thinking on their structure.

48244 (UCID—18124) **On-line estimator/detector design for a plutonium nitrate concentrator unit.** Candy, J.V.; Rozsa, R.B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Apr 1979. Contract W-7405-ENG-48. 87p. Dep. NTIS, PC A05/MF A01.

In this report we consider the design of a nonlinear estimator to be used in conjunction with on-line detectors for a plutonium/concentrator. Using a complex state-of-the-art process model to simulate realistic data, we show that the estimator performance using a simplified process model is adequate over a wide range of operation. The estimator is used to simulate and characterize some on-line diversion detectors, i.e., detectors designed to indicate if some of the critical special nuclear material in process is stolen or diverted from the unit. Several different diversion scenarios are presented. Simulation results indicate that the estimators and detectors yielded reasonable performance for the scenarios investigated.

48245 (UCRL—15030) **Toward analytic aids for standard setting in nuclear regulation.** Brown, R.V.; O'Connor, M.F.; Peterson, C.R. (Decisions and Designs, Inc., McLean, VA (USA)). May 1979. Contract W-7405-ENG-48. 63p. Dep. NTIS, PC A04/MF A01.

US NRC promulgates standards for nuclear reprocessing and other facilities to safeguard against the diversion of nuclear material. Two broad tasks have been directed toward establishing performance criteria for standard settings: general-purpose modeling, and analysis specific to a particular performance criterion option. This report emphasizes work on the second task. Purpose is to provide a framework for the evaluation of such options that organizes the necessary components in a way that provides for meaningful assessments with respect to required inputs. (DLC)

48246 (UCRL—82213) **Procedure for the assessment of material control and accounting systems.** Parziale, A.A.; Sacks, I.J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Jul 1979. Contract W-7405-ENG-48. 10p. (CONF-790707—13). Dep. NTIS, PC A02/MF A01.

From 20. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (16 Jul 1979).

For the United States Nuclear Regulatory Commission, a procedure was developed and tested for the evaluation of Material Control and Accounting (MC and A) Systems at nuclear fuel facilities. This procedure, called the Structured Assessment Approach, SAA, subjects the MC and A system at a facility to a series of increasingly sophisticated adversaries and strategies. A fully integrated version of the computer codes which assist the analyst in this assessment will become available in October 1979. The concepts of the SAA and the results of the assessment of a hypothetical but typical facility are presented.

48247 (UCRL—82335) **TASTEX gamma spectrometer system for measuring isotopic and total plutonium concentrations in solutions.** Gunnink, R.; Prindle, A.L.; Niday, J.B.; Van Lehn, A.L.; Asakura, Y. (California Univ., Livermore (USA). Lawrence Livermore Lab.; Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). 18 Jun 1979. Contract W-7405-ENG-48. 11p. (CONF-790707—10). Dep. NTIS, PC A02/MF A01.

From 20. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (16 Jul 1979).

Described is a computer-based gamma ray spectrometer system using a germanium detector for rapid nondestructive measurement of isotopic and total plutonium concentrations in solutions at nuclear reprocessing plants. Isotopic concentrations have been measured with an accuracy of +-0.5%. Cell design, calibration techniques, and preliminary results are discussed. This system is being installed at the Tokai reprocessing plant in Japan.

48248 (UCRL—82421) **Tempering of accounts and records to disguise SNM theft.** Lim, J.J.; Huebel, J.G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jul 1979. Contract W-7405-ENG-48. 9p. (CONF-790707—9). Dep. NTIS, PC A02/MF A01.

From 20. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (16 Jul 1979).

A typical nuclear material accounting system employing double-entry bookkeeping is described. A logic diagram is used to model the interactions of the accounting system and the adversary when he attempts to thwart it. Boolean equations are derived from the logic diagram; solution of these equations yields the accounts and records through which the adversary may disguise SNM theft and the collusion requirements needed to accomplish this feat.

FUSION FUELS

PROCESSING

FABRICATION AND TESTING

48249 (LA—7619-P) **Advanced laser fusion target fabrication research and development proposal.** Stupin, D.M.; Fries, R.J. (Los Alamos Scientific Lab., NM (USA)). May 1979. Contract W-7405-ENG-36. 15p. Dep. NTIS, PC A02/MF A01.

A research and development program is described that will enable the fabrication of 10^6 targets/day for a laser fusion prototype power reactor in 2007. We give personnel and cost estimates for a generalized laser fusion target that requires the development of several new technologies. The total cost of the program between 1979 and 2007 is $362 million in today's dollars.

48250 (UCRL—81415(Rev.1)) **Fabrication of glass sphere laser fusion targets.** Hendricks, C.D.; Rosencwaig, A.; Woerner, R.L.; Koo, J.C.; Dressler, J.L.; Sherohman, J.W.; Weinland, S.L.; Jeffries, M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 May 1979. Contract W-7405-ENG-48. 18p. (CONF-790125—75). Dep. NTIS, PC A02/MF A01.

From 1. topical meeting on fusion reactor materials; Miami Beach, FL, USA (29 Jan 1979).

We have developed processes at LLL for mass producing the high quality glass microspheres required for current laser fusion targets. Here we describe the methods and the materials used in our liquid-droplet and dried-gel systems. Glass microspheres ranging from 70 to 600 microns O.D., with walls from 0.5 to 18 microns thick and which satisfy the exacting surface and symmetry specifications of targets for high density experiments are now produced routinely.

48251 (UCRL—81842) **Characteristics of thick non-planar SiO_2 coatings.** Meyer, S.F.; Hsieh, E.J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Apr 1979. Contract W-7405-ENG-48. 14p. (CONF-790442—15). Dep. NTIS, PC A02/MF A01.

From International conference on metallurgical coatings; San Diego, CA, USA (23 Apr 1979).

We have successfully developed a new process for making strong, smooth, thick SiO_2 films on hemispherical Kovar mandrels of various sizes designed for multishell Laser Fusion Targets. The surface finish obtainable with a 13 μm thick SiO_3 coating on a 260 μm dia. mandrel is approximately 30 nm peak-to-peak, with a few defects of roughly 0.3 μm deep. The rf magnetron sputtered SiO_2 films were dense and crystalline.

BY-PRODUCTS

48252 (GA-A—15371) **Study of chemical production utilizing fusion neutrons. Progress report, March—September 1978.** Rovner, L; Goodrich, R.; Jensen, B. (General Atomic Co., San Diego, CA (USA)). Apr 1979. 121p. Dep. NTIS, PC A06/MF A01.

Chapters are devoted to the characteristics of fusion energy (heat utilization and tritium breeding characteristics), thermal spike chemistry, high-temperature thermochemical water splitting (General Atomic sulfur/iodine cycle, magnetite/wistite cycle, sodium ferrate cycle, and calcium iodate cycle), and thermal fixation of nitrogen from air.

PROPERTIES

48253 (UCRL—52628) **Cryogenic hydrogen data pertinent to magnetic fusion energy.** Souers, P.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Mar 1979. Contract W-7405-ENG-48. 94p. Dep. NTIS, PC A05/MF A01.

To aid future hydrogen fusion researchers, I have correlated the measured physical and chemical properties of the hydrogens below 30°K. I have further estimated these properties for deuterium—deuterium tritide—tritium (D_2—DT—T_2) fusion fuel. My resulting synthesis offers a timely view and review of cryogenic hydrogen properties, plus some hydrogen data to room temperature. My general thrust is for workers new to the field, although my discussion of the scientific background of the material would suit specialists.

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

REFER ALSO TO CITATION(S) 48772

USES

REFER ALSO TO CITATION(S) 48731

HYDROGEN

REFER ALSO TO CITATION(S) 48749

PRODUCTION

48254 **Economics of hydrogen production.** Grogery, D.P.; Tsaros, C.L.; Arora, J.L.; Nevrekar, P. Chicago, IL; Institute of Gas Tech., Chicago, IL (1979). 28p. (CONF-790415—39). Institute of Gas Technology, 3424 South State Street, IIT Center, Chicago, IL.

From 177. ACS national meeting; Honolulu, HI, USA (1 Apr 1979).

There is no simple answer to the question how much does hydrogen cost to produce? Hydrogen production today takes place from natural gas, oil, and coal as feedstocks, and by electrolysis, each process having conflicting and contrasting economics. In the future, hydrogen production from nuclear energy and the various forms of solar energy are contemplated, and new improved technologies for all of these production routes are under development. This paper discussed the relative sensitivities of hydrogen cost to capital, feedstock, and utility prices for various different types of production processes, outlines some process selection criteria for different applications, and indicates what changes in process economics might be anticipated from new technical developments.

ELECTROLYSIS

REFER ALSO TO CITATION(S) 48294, 48309

THERMOCHEMICAL PROCESSES

REFER ALSO TO CITATION(S) 48252

CHEMISORPTION

REFER ALSO TO CITATION(S) 48899, 48926

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 48254

SAFETY

REFER ALSO TO CITATION(S) 48988

OTHER SYNTHETIC AND NATURAL FUELS

REFER ALSO TO CITATION(S) 48749

PREPARATION

CHEMICAL SYNTHESIS

REFER ALSO TO CITATION(S) 48045, 48307

PREPARATION FROM WASTES OR BIOMASS

REFER ALSO TO CITATION(S) 48043, 48304

48255 (COO—2917-14) **Biological conversion of biomass to methane. Quarterly progress report, December 1—February 28, 1979.** Pfeffer, J.T. (Illinois Univ., Urbana (USA). Dept. of Civil Engineering). Mar 1979. Contract EY-76-S-02-2917. 15p. Dep. NTIS, PC A02/MF A01.

Research on the viability of wheat straw as a feedstock for methane production is reported. The efficiency for methane production was somewhat better than that of corn stover. Thermochemical pretreatment consisting of the addition of NaOH and steam injection was investigated to study the potential for improvement of the conversion efficiency. Experimental data clearly shows significant inhibition of methane production as a result of the pretreatment. Studies are underway to determine an acceptable level of caustic pretreatment and required dilution to eliminate inhibitory effects. (JSR)

48256 (COO—2982-38) **Conversion of cellulosic and waste polymer material to gasoline.** Kuester, J.L. (Arizona State Univ., Tempe (USA). Coll. of Engineering and Applied Sciences). 28 Mar 1979. Contract EY-76-S-02-2982. 51p. Dep. NTIS, PC A04/MF A01.

The present status and future plans for a project to convert cellulosic (biomass) and waste synthetic polymer materials to quality liquid fuels is presented. A thermal gasification approach is utilized followed by catalytic liquid fuels synthesis steps. Potential products include a medium quality substitute for natural gas or liquid fuel equivalents of diesel fuel, kerosene or high octane gasoline. The process appears very flexible with regard to ability to handle different sources of feedstock. Results to date indicate quality products can be produced. Product yields need to be improved with the main thrust centered on improvement of pyrolysis gas composition. This will be a major effort in the new contract period. Other items to be addressed are study of alternate economic feedstocks, waste stream characterization, and liquid fuels synthesis and tailoring with particular attention on the effects of alternate feedstocks. A description of a proposed 10 ton/day pilot plant is presented with flow sheet, material balance and cost estimates.

48257 (COO—4862-3) **Assessment of the technical and economic feasibility of converting wood residues to liquid and gaseous fuel products using state-of-the-art and advanced coal conversion technology. Third quarterly report, December 1, 1978—February 28, 1979.** (Gorham International, Inc., ME (USA)). May 1979. Contract ET-78-C-02-4862. 15p. Dep. NTIS, PC A02/MF A01.

The approach to be used in evaluating coal gasification technologies for gasification of wood is outlined. The coal gasification technologies to be evaluated and their status are tabulated. The parameters critical to the development of wood gasification (technical risk, economics, institutional factors, and environmental impacts) are briefly discussed. (JSR)

48258 (PNL—2815) **Operational characteristics of anaerobic digesters at selected municipal wastewater treatment facilities in the United States.** Spencer, R.R.; Wong, A.L.; Coates, J.A.; Ahlstrom, S.B. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Dec 1978. Contract EY-76-C-06-1830. 40p. Dep. NTIS, PC A03/MF A01.

Bench-scale and pilot plant studies at Pacific Northwest Laboratory have shown that powdered activated carbon is effective in improving volatile solids destruction and gas production in anaerobic digesters that are operating at less than normally expected levels of efficiency. To evaluate the applicability of this technology to digesters in the United States, digester operating characteristics at 60 facilities were surveyed and the number of stressed digesters estimated. The results show that although median values of the operating parameters conformed with those of a well-operated digester, 30% of the digesters surveyed were stressed with regard to at least one important parameter. Of the 30 largest treatment plants in the U.S., 7 fell into this category. Digester gas production and usage were then examined to determine the importance of methane off-gas as an energy source. A conservative estimate is that the gas produced

nationally represents a heating value of about 2.36 x 10^{13} Btu/year with a present value of $40 million. Of this amount, an estimated 75% is used either onsite or sold. Onsite uses include heating digesters and buildings, incinerating sludge, operating equipment, and generating electricity. The other 25% is flared and the energy value lost. The present value of the flared gas is about $10 million/year. Natural gas prices are projected to increase 150% over the next 7 years. If the present utilization ratio continues, the flared gas will be worth approximately $27 million in 1985. Presently, digester gas is mainly used for process heating and operating equipment. The technical and economic feasibility of recovering digester gas for electrical power generation, onsite equipment operation, and sales to other consumers (utilities, private companies) should be thoroughly investigated. If fuel gas recovery and utilization are found to be desirable, consideration should be given to expanding and upgrading anaerobic digester facilities in the U.S.

ALCOHOL FUELS

48259 (DOE/PE—0012) **Report of the Alcohol Fuels Policy Review.** (Department of Energy, Washington, DC (USA)). Jun 1979. 129p. Dep. NTIS, PC A07/MF A01.

Four chapters and subchapter titles are: Alcohol Fuels Potential (Alcohol Potential for Petroleum Savings, Current Federal Incentives, Demand for Gasohol); Alcohol Fuels Policy Issues (Food Versus Fuel, Raw Material Supplies, Alcohol Production Economics, Small-Scale Operations, Net Energy Balance, Oil Replacement Value, Environmental Impacts); Policy Initiatives (Strategy and Recent Actions in Support of Alcohol Fuels); Additional Policies and Actions (Extended Excise Tax Exemption, etc.). Additional information in 4 appendices presented is current status of alcohol fuels, raw material availability and economics, alcohol production technologies and economics, and potential applications of alcohol fuels.

48260 (HCP/J6639—01) **Grain motor fuel alcohol technical and economic assessment study.** (Katzen (Raphael) Associates, Cincinnati, OH (USA)). Jun 1979. Contract EJ-78-C-01-6639. 368p. Dep. NTIS, PC A16/MF A01.

This study evaluates the technical and economical feasibility for production of motor-fuel alcohol from a plant with a capacity of 50 million US gallons per year. The evaluation includes a detailed process design using proven technology, a complete budget estimate of the plant investment including working capital, a detailed analysis of the annual operating cost using corn as the primary feedstock, and a complete financial analysis which establishes the alcohol selling price required to net to the investor a 15% discounted cash flow - interest rate of return. This is called the base case evaluation. In addition, other considerations for production of motor-fuel alcohol were evaluated and are discussed here, namely: excursions on plant capacities; excursions on feedstock material; sensitivity analyses on financial parameters; and substitution of corn stover for coal as the fuel source. The report also includes an assessment and commentary on the agricultural, technological, and economic impact of a major gasohol program in the US.

PROPERTIES

REFER ALSO TO CITATION(S) 48095

CHEMICAL SYNTHESIS

REFER ALSO TO CITATION(S) 48307

SOLID WASTE FUELS

REFER ALSO TO CITATION(S) 48304

HYDRO ENERGY

REFER ALSO TO CITATION(S) 48750

48261 **Use of rock anchors at Tarbela.** *Int. Water Power Dam Constr.;* **30**: No. 2, 44-47(Feb 1978).

The repair work to the floor of stilling basin number three at the Tarbela Dam in Pakistan involved the use of almost 60 prestressed rock anchors, fabricated and assembled on site. The way in which the work was organized, an the ways in which the anchors were installed are described, preceded by a short introduction to the background of Tarbela's troubled history.

RESOURCES AND AVAILABILITY

48262 **Hydroelectric potential: East Cape.** Tonkin; Taylor. Auckland, New Zealand; New Zealand Energy Research and Development Committee (1978). 55p. (NZERDC—40).

Within the study area the total hydro generation potential that might conceivably be developed economically is estimated in very approximate terms to amount to about 500 GWh annually. This potential is best considered in terms of two types of schemes, namely: low-head high-volume schemes geerally on main rivers; and small high-head schemes on upland tributaries. The potential for major hydro development in the lower reaches of the two main rivers, the Waipaoa and Waiapu, can be immediately discounted owning to lack of suitable dam sites, inherently unstable terrain, and severe sediment problems. However, there appears to be some potential for development of conventional (i.e., dam and adjacent power house) hydro schemes in the middle and lower reaches of some secondary rivers whose mean flow exceeds about 15 m^3/s. Potentially suitable combinations of adequate river flow and gorge dam sites exist most noticeably on the Raukokore River, and on the Mata River, the principal tributary of the Waiapu River. Potential also exists for development of small hydro schemes on streams which drain the eastern slopes of the Raukumara Range. High rainfall combined with relatively stable river courses and steep river gradients favor development of diversion schemes comprising a diversion weir, supply conduit (generally by tunnel), and remote power house.

SITE GEOLOGY AND METEOROLOGY

48263 (AD-A—061039) **Liquefaction potential of dams and foundations. Report 5. Development of a constitutive relation for simulating the response of saturated cohesionless soil. Research report, September 1976—August 1977.** Baladi, G.Y.; Rohani, B. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA)). Aug 1978. 64p. NTIS PC A04/MF A01.

This report documents the development of a three-dimensional elastic-plastic isotropic constitutive model for earth materials and demonstrates its ability to simulate a wide variety of observed stress-strain-pore pressure responses of fully saturated cohesionless soils. The model reproduces the hysteretic behavior exhibited by these materials when tested under hydrostatic and deviatoric states of stress, and accounts for shear-induced volume changes, strain-softening response, and progressive increases in pore pressure due to subfailure cyclic loadings. The undrained condition for fully saturated materials is simulated by the assumption that for each loading increment, the corresponding increment of volumetric strain is zero. The behavior of the model under simulated undrained triaxial test conditions is examined in detail and correlated with experimental data for saturated Reid-Bedford Model sand and Banding sand. It is recommended that the present constitutive model be incorporated into a suitable computer code for use in conducting numerical effective-stress analyses aimed at assessing the liquefaction potential of earth dams or other earth structures subjected to earthquake-type loadings. (Author)

ENVIRONMENTAL ASPECTS

48264 (CONF-790379—1) **Potential environmental impacts of hydroelectric development: an overview.** Hildebrand, S.G. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 17p. Dep. NTIS, PC A02/MF A01.

From Hydropower: a national energy resource workshop; Easton, MD, USA (11 Mar 1979).

The potential environmental impacts of hydroelectric power developments are reviewed by discussing the impacts of building and operating man-made reservoirs and dams, the effects on ecosystems downstream from a power plant, legislation related to hydropower development, and environmental planning. (LCL)

SOLAR ENERGY

REFER ALSO TO CITATION(S) 48750

ECONOMICS

REFER ALSO TO CITATION(S) 48266

48265 (SERI/TP—34-262) **Technical and economic assessment of three solar conversion technologies.** Kreith, F. (Solar Energy Research Inst., Golden, CO (USA)). 1979. Contract EG-77-C-01-4042. 62p. (CONF-790732—1). Dep. NTIS, PC A04/MF A01.

From United Nations/economic commission for Europe siminar on cooperative technological forecasting; Solar Energy; Puerto De La Cruz, Tenerife, Canary Islands, Spain (2 Jul 1979).

Photoelectric energy conversion, solar electric thermal conversion, and direct solar thermal conversion are examined from the point of view of technical and economic viability. The key conclusions of this examination are that all three of these solar thermal conversion technologies are technically viable today. However, only the direct solar thermal heat applications appear to be close to economically viability. If it is assumed that a lead time of approximately 25 years is required before a technical innovation can be placed on the market in a large scale, only direct applications of solar thermal energy, such as for heating water or providing industrial process heat, appear to have the potential of making major market penetration in this century. At the present time, the useful energy delivered from an industrial process heat system is within a factor of two of competing with systems using electric resistance heating or fossil fuel such as oil or coal. The technologies for direct application of solar thermal energy are mature and within technical and economical reach of mass production and installation. There exists no economically viable energy storage system compatible with industrial heat application temperatures, but a large penetration of the market appears feasible by designing solar systems that do not exceed the minimal load requirement of the industrial process and thereby utilize all available thermal energy directly.

ENVIRONMENTAL, LEGAL, AND INSTITUTIONAL ASPECTS

REFER ALSO TO CITATION(S) 48279, 48328

48266 (SERI/TP—52-138) **Role of the government in the development of solar energy.** Yokell, M.D. (Solar Energy Research Inst., Golden, CO (USA)). 1979. Contract EG-77-C-01-4042. 30p. (CONF-790122—3). Dep. NTIS, PC A03/MF A01.

From Annual meeting of the American Association for the Advancement of Science; Houston, TX, USA (3 Jan 1978).

The economic rationale for a federal solar energy subsidy program, the type of program required, and methods for determining the proper funding level for each program are discussed. An introduction offers a brief description of solar technologies. A summary of the current federal solar subsidy program is also provided. Nonsubsidy programs, such as the promulgation of federal standards for solar manufacturers, are not discussed.

48267 (SERI/TR—62-069) **Solar energy legal bibliography. Final report.** Seeley, D.; Euser, B.; Joyce, C.; Morgan, G.H.; Laitos, J.G.; Adams, A. (Solar Energy Research Inst., Golden, CO (USA)). Mar 1979. Contract EG-77-C-01-4042. 169p. Dep. NTIS, PC A08/MF A01.

The Solar Energy Legal Bibliography is a compilation of approximately 160 solar publications abstracted for their legal and policy content (through October 1978). Emphasis is on legal barriers and incentives to solar energy development. Abstracts are arranged under the following categories: Antitrust, Biomass, Building Codes, Consumer Protection, Environmental Aspects, Federal Legislation and Programs, Financing/Insurance, International Law, Labor, Land Use (Covenants, Easements, Nuisance, Zoning), Local Legislation and Programs, Ocean Energy, Patents and Licenses, Photovoltaics, Solar Access Rights, Solar Heating and Cooling, Solar Thermal Power Systems, Standards, State Legislation and Programs, Tax Law, Tort Liability, Utilities, Warranties, Wind Resources, and General Solar Law.

48268 (SERI/TR—62-204) **Selected legal and institutional issues related to Ocean Thermal Energy Conversion (OTEC) development.** Nanda, V.P. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1979. Contract EG-77-C-01-4042. 54p. Dep. NTIS, PC A04/MF A01.

Ocean Thermal Energy Conversion (OTEC), an attractive alternative to traditional energy sources, is still in the early stages of development. To facilitate OTEC commercialization, it is essential that a legal and institutional framework be designed now so as to resolve uncertainties related to OTEC development, primarily involving jurisdictional, regulatory, and environmental issues. The jurisdictional issues raised by OTEC use are dependent upon the site of an OTEC facility and its configuration; i.e., whether the plant is a semipermanent fixture located offshore or a migrating plant ship that provides a source of energy for industry at sea. These issues primarily involve the division of authority between the Federal Government and the individual coastal states. The regulatory issues raised are largely speculative: they involve the adaptation of existing mechanisms to OTEC operation. Finally, the environmental issues raised center around compliance with the National Environmental Policy Act (NEPA) as well as international agreements. 288 references.

48269 (SERI/TR—62-255) **Regulated utilities and solar energy: a legal-economic analysis of the major issues affecting the solar commercialization effort.** Laitos, J.; Feuerstein, R.J. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1979. EG-77-C-01-4042. 131p. Dep. NTIS, PC A07/MF A01.

The reaction of public utilities to the addition (and competitive) sources of energy supplied by solar technologies will have a significant impact on the commercialization of solar energy. Decentralized applications of solar energy need utility-produced power to back up the energy produced by solar means. The cost and availability of this power will largely determine the acceptance of solar energy. There are three legal issues surrounding the role of utilities in the solar commercialization effort: (1) the extent to which utilities may own, sell, lease, finance, or service solar devices for utility customers; (2) the degree to which solar-powered utilities may be able to compete with existing utilities; and (3) the degree to which various utility rate structures will be allowed to penalize decentralized solar users. The impact of state constitutional and statutory provisions upon these issues is examined, along with relevant federal constitutional doctrines. Finally, the statutes of the National Energy Act, many of which specifically address the above issues, are discussed.

SOLAR ENERGY CONVERSION

PHOTOVOLTAIC CONVERSION

REFER ALSO TO CITATION(S) 48265, 48310, 48476

48270 (COO—4094-38) **Test plan for phase-1 residential testing at the MIT/LL PV Systems Test Facility.** Sacco, S.B. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 30 Mar 1979. Contract EY-76-C-02-4094. 23p. Dep. NTIS, PC A04/MF A01.

This test plan describes the objectives, power system, instrumentation, and data processing for a utility off-peak photovoltaic power system to be tested at the MIT/LL Photovoltaic Systems Test Bed. This plan constitutes the first in a series of residential PV system tests that will be conducted at this facility. When subsequent tests are defined, they will be described in a test plan similar to this one. This test is designed to represent a residential system powering the diversified electrical load (stove, refrigerator, dryer, etc.) of a single-family residence. An 8-kW photovoltaic array is used along with 50-kW of lead-acid battery storage and a 6-kW dc-to-ac inverter. Leads, using actual appliances, are timer controlled to represent a typical residential usage profile and backup electrical power is provided by the local utility in an off-peak-only basis.

48271 (COO—4094-41) **Description of the MIT/Lincoln Laboratory photovoltaic systems test facility.** Sacco, S.B. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 30 Jun 1979. Contract EY-76-C-02-4094. 26p. Dep. NTIS, PC A03/MF A01.

This document describes the Massachusetts Institute of Technology/Lincoln Laboratory Photovoltaic Systems Test Facility and the mechanical and electrical interfaces for items to be tested. These interfaces include those for the solar array, batteries, inverters, and for backup DC power sources. Permanent power and instrumentation wiring at the facility are described in sufficient detail to permit test plans to be drawn up from these descriptions.

48272 (DOE/JPL—1012-3-T1) **Low-Cost Solar Array (LSA) Project. Project quarterly report No. 9, April—June 1978.** (Jet Propulsion Lab., Pasadena, CA (USA)). 1978. Contract EX-76-A-29-1012. 59p. (JPL-PUB—79-15). Dep. NTIS, PC A04/MF A01.

Progress made by the Low-Cost Solar Array Project during the period April through June 1978 is described. It includes reports on silicon material processing, large-area silicon sheet development, encapsulation materials testing and development, project engineering and operations activities, and manufacturing techniques, plus the steps taken to integrate these efforts.

48273 (DOE/JPL—1012-7-T3) **LSA Project: technology development update.** Goldsmith, J.V.; Bickler, D.B. (Jet Propulsion Lab., Pasadena, CA (USA)). 30 Aug 1978. Contract EX-76-A-29-1012. 27p. Dep. NTIS, PC A03/MF A01.

Copies of the viewgraphs and a condensation of the comments by John V. Goldsmith and Donald B. Bickler of the LSA Project at its 10th Project Integration Meeting, August 16 and 17, 1978, at Caltech University, Pasadena, California, are presented. Their presentations focus on the state of the technology aimed at achieving the $500/kW goal by 1986.

48274 (DOE/JPL/1012—78/1(Vol.2)) **Historical evidence of importance to the industrialization of flat-plate silicon photovoltaic systems.** Smith, J.L.; Gates, W.R.; Lee, T. (Jet Propulsion Lab., Pasadena, CA (USA)). Apr 1978. Contract EX-76-A-29-1012. 69p. (JPL-PUB—78-36(Vol.2)). Dep. NTIS, PC A04/MF A01.

The results of a literature search on the diffusion of new industrial production processes and the determinants of success of previous federally-funded demonstration projects are presented. The industrialization goal of the LSSA project is analyzed. The conclusions of that analysis are used to develop recommendations with respect to pilot, demonstration, and commercial scale production plants, as well as the disposition of the LSSA annual output goal. (MHR)

48275 (DOE/JPL/954144—1) **Silicon ribbon growth by a capillary action shaping technique. Final report, May 8, 1975—November 8, 1977.** Schwuttke, G.H.; Ciszek, T.F.; Kran, A. (International Business Machines Corp., Hopewell Junction, NY (USA). East Fishkill Lab.). 1977. Contract NAS-7-100-954144. 353p. Dep. NTIS, PC A16/MF A01.

The crystal growth method under investigation is a capillary action shaping technique. Meniscus shaping for the desired ribbon geometry occurs at the vertex of a wettable die. As ribbon growth depletes the melt meniscus, capillary action supplies replacement material. The objective of the work is to attain a clear technological assessment of silicon ribbon growth by the capillary action shaping technique and to enhance the applicability of the technique to photovoltaic power device material. The results of crystal growth studies, structural and electrical characterization of cast silicon ribbons, and a silicon ribbon technology assessment are described. (WHK)

48276 (DOE/NASA/20485—79/1) **Description of photovoltaic village power systems in the United States and Africa.** Ratajczak, A.F.; Bifano, W.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1979. 14p. (NASA-TM—79149; CONF-790457—4). Dep. NTIS, PC A02/MF A01.

From 1979 photovaltaic solar energy conference; West Berlin, F.R. Germany (23 Apr 1979).

The NASA Lewis Research Center has designed, fabricated, and installed two photovoltaic power systems in remote villages in the United States and Africa. These projects were undertaken to demonstrate that existing photovoltaic system technology is capable of providing electrical power for basic domestic services for the millions of small, remote communities in both developed and developing countries. One system is located in the Papago Indian Village of Schuchuli in southwest Arizona (USA) and bacame operational 16 December 1978. The other system is located in Tangaye, a rural village in Upper Volta, Africa. It became operational 1 March 1979. The Schuchuli system has a 3.5 kW (peak) solar array which provides electric power for village water pumping, a refrigerator for each family, lights in the village buildings, and a community washing machine and sewing machine. The 1.8 kW (peak) Tangaye system provides power for community water pumping, flour milling and lights in the milling building. These are both stand-alone systems (i.e., no back-up power source) which are being operated and maintained by local personnel. Both systems are insutrumented. Systems operations are being monitored by NASA to measure design adequacy and to refine designs for future systems. Baseline socioeconomic studies have been performed for both villages. Follow-up studies are planned to determine the impact of the power systems on the villagers. The designs, hardware, and installations for both systems are described.

48277 (DOE/TIC—10162) **Mobil Tyco Solar Energy Corp. Second quarterly progress report, January 31, 1979—March 31, 1979.** (Mobil Tyco Solar Energy Corp., Waltham, MA (USA)). 14 May 1979. Contract W-7405-ENG-48. 325p. Dep. NTIS, PC A14/MF A01.

A materials science approach is taken to the recombination and device problems of amorphous silicon material. To address the recombination problem a systematic study of the materials is to be undertaken; first, by substituting for various percentages of the Si the various group IV atoms, C, Ge, Sn, and combinations of these. Secondly, the group IA atoms, Li, Na, K, or combinations of these will be substituted for the hydrogen, either wholly or in part. Progress is reported.

48278 **Power output control circuit for solar-powered cathodic protection system.** Galberth, R.L.; Arnold, R.L.; Bollinger, J.C. US Patent 4,136,309. 23 Jan 1979. Filed date 1 Jul 1977. 6p.

Metallic structures located in an electrolyte, such as soil or water, for example, tend to corrode. In order to prevent metal loss from the structure due to corrosion, a dc current flow is created in the metal structure. This current flow causes a hydrogen ion film to form on the structure which insulates it from the electrolyte. The direct current is supplied to the metal structure by a combination of a solar array and storage batteries. During peak solar activity, the solar array both charges the batteries and supplies current to the metal structure. When the batteries are fully charged, the batteries are disconnected and the entire solar array output is applied to the metal structure. If solar activity decreases below a predetermined level, the batteries are switched back into the circuit to maintain current flow at a predetermined minimum level.

48279 (LA—7866-TASE) **Decentralized solar photovoltaic energy systems.** Krupta, M.C. (Los Alamos Scientific Lab., NM (USA)). Jun 1979. Contract W-7405-ENG-36. 110p. Dep. NTIS, PC A06/MF A01.

Environmental data for the decentralized solar photovoltaic systems have been generated in support of the Technology Assessment of Solar Energy Systems program (TASE). Emphasis has been placed upon the selection and use of a model residential photovoltaic system to develop and quantify the necessary data. The model consists of a reference home located in Phoenix, AZ utilizing a unique solar cell array-roof shingle combination. Silicon solar cells, rated at 13.5% efficiency at 28°C and 100 mW/cm² (AMI) insolation are used to generate ~ 10 kW (peak). An all-electric home is considered with lead-acid battery storage, dc-ac inversion and utility backup. The reference home is compared to others in regions of different insolation. Major material requirements, scaled to quad levels of end-use energy include signifcant quantities of silicon, copper, lead, antimony, sulfuric acid and plastics. Operating residuals generated are negligible with the exception of those from the storage battery due to a short (10-year) lifetime. Land requirements are negligible. Water requirements are minor. Advanced production techniques are still undergoing development precluding adequate determination of production process residuals. A brief general discussion of other environmental, health, and safety and resource availability impacts is presented.

48280 (NP—23869) **California state photovoltaic program: a program plan.** (Jet Propulsion Lab., Pasadena, CA (USA)). 1 Mar 1978. 75p. California Energy Resource Conservation and Development Commission, Sacramento, CA.

A photovoltaics program to be conducted by the proposed State of California Energy Development Authority is described. The program is oriented toward photovoltaic systems and applications thereof rather than technology development. this orientation best serves the interests of the State of California by focusing on questions related to the feasibility of wide-spread adoption within the state. The overall program consists of two smaller programs, the Photovoltaic Innovations Program and the Cooperative Photovoltaic Application Projects (CoPAPs) Program. The Innovations Program deals in ideas; it is structured to provide unencumbered support to groups and individual innovators who can bring creative system design and engineering talents to bear on the largely unexplored field of photovoltaic systems. Qualified participants will be solicited, and one or more of several assistance mechanisms (e.g. grants or participatory agreements) will be utilized to indicate a multistep process whereby further awards are available based on achievement. The CoPAPs Program provides cooperative support to projects wherein real photovoltaic systems are operated by actual users in real applications. Several application areas, including water pumping or treatment and residences, are identified for major emphasis. A wide variety of sites and users will be sought, and as in the Innovations Program a variety of support mechanisms will be available (most will require cost sharing in some form of the project coparticipants).

48281 (SAN—1580-T1) **Cadmium sulfide/copper ternary heterojunction cell reach. Technical progress quarterly report, January 1, 1979—April 8, 1979.** (Sperry Univac, St. Paul, MN (USA). Defense Systems Div.). 1979. Contract EG-77-C-03-1580. 15p. Dep. NTIS, PC A02/MF A01.

The first quarter of work on a CdS/CuInSe cell research program is discussed. Efforts were directed toward fabricating $CuInSe_2$ films using rf sputtering, flash evaporation, and dual source, Se and $CuInSe_2$, coevaporation to obtain p type films. Film electrical characteristics are discussed. Measurements of vapor stream composition using EIES and test strip depositions were conducted. An analysis cell grid design is presented.

48282 (SAND—78-2181C) **Status of the photovoltaic systems definition project.** Biringer, K.L.; Jones, G.J.; Smith, D.R.; Post, H.N. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 5p. (CONF-790541—38). Dep. NTIS, PC A02/MF A01.

From International Solar Energy Society meeting; Atlanta, GA, USA (28 May 1979).

Two of the areas of project responsibility, systems analysis and subsystem technology development, are discussed. The systems analysis task spans work in application analysis, systems design and optimization, and system cost and performance requirements. A summary of results of recently completed application analysis studies are given as well as discussions and references to other design guidelines available or in preparation. Within subsystem technology development are three subsystem categories. These include array

subsystems, power conditioning and energy storage. Low cost structures work done as a part of array system technology are reviewed. Also present activities in power conditioning for photovoltaics are discussed. Activities in each of these areas include establishment of performance requirements, hardware development and evaluation testing.

48283 (SAND—78-2186C) **Design of photovoltaic systems for residential applications in the United States.** Jones, G.J. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract AC04-76DP00789. 7p. (CONF-790457—3). Dep. NTIS, PC A02/MF A01.

From 1979 photovaltaic solar energy conference; West Berlin, F.R. Germany (23 Apr 1979).

Single family residences may represent one of the most promising future applications for photovoltaic systems. For this reason extensive analysis of potential systems for this sector was undertaken on a regional basis for the continental United States. Assuming installation in the period 1986 and beyond, this work considered numerous subsystem options, and a variety of operational modes and economic scenarios. Fifteen specific sites were analyzed, representing the different climatic conditions available in the continental United States. System rankings based on lifecycle cost effectiveness were obtained for each site by means of hourly modeling calculations using this inuput data. Results indicate that all-electric systems using high efficiency heat pump technology appear viable at nearly all sites. For thermal collector systems to be generally competitive, (either separate or combined thermal collectors), it was found that their installed system cost per square meter of collector area must approach that projected for the photovoltaic system. Systems which feed excess power back onto the utility grid were compared to those using on-site energy storage. For sell-back rates as low as one-half of the rate to the consumer, the battery system was found to be noncompetitive, except at optimistic future price projections.

48284 (SAND—78-2187C) **Status of the US Department of Energy Photovoltaic Concentrator Development Project.** Shafer, B.D.; Boes, E.C.; Edenburn, M.W.; Schueler, D.G. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract AC04-76DP00789. 8p. (CONF-790457—2). Dep. NTIS, PC A02/MF A01.

From 1979 photovaltaic solar energy conference; West Berlin, F.R. Germany (23 Apr 1979).

The overall objective of this project is to develop a photovoltaic concentrator technology which results in low-cost, long-life photovoltaic arrays at a price of less than $0.50 per peak watt by 1986. The general approach is to identify and develop those concentrator concepts which have the highest potential for low-cost and long-life by supporting technology and increasing solar array production capability. The principal criterion is to develop concentrating arrays that provide the lowest life cycle energy cost. The work that DOE is funding in the areas of concentrator cells, concentrator modules and complete arrays is surveyed. Highlights of work done to date in cell development include 18 to 20% efficient silicon cells and 28.5% efficient PV cell assemblies using GaAlAs and Si cells in conjunction with spectral splitting. In the area of concentrator modules a number of different types have been fabricated and evaluated. These include Fresnel lens modules, actively and passively cooled parabolic trough designs, and parabolic dish units. Full scale 10 kW arrays including a Fresnel lens design and a passively cooled off-axis parabolic trough design are being fabricated and tested. The results of evaluating these various designs in regard to their ability to produce cost effective energy will be presented.

48285 (SAND—79-1008C) **Optimization of multi-layer AR coatings.** Sexton, F.W. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract AC04-DP7600789. 3p. (CONF-790547—1). Dep. NTIS, PC A02/MF A01.

From Electrochemical Society meeting; Boston, MA, USA (7 May 1979).

A computer code to optimize multi-layer AR coatings for terrestrial solar cell applications has been developed. The optimum thicknesses of up to 15 layers are determined using a sequential search technique which maximizes the integral of the product of the internal spectral response of a given cell, the solar spectrum at AM 1, 1.5, or 2, and the transmittance of the AR coating. This optimization criterion allows the AR coating to be designed to match the spectral response of a given cell and the solar spectrum in which it will operate. All coatings reported were developed for a p^+nn^+ cell design with a back-surface aiding field.

48286 (SAND—79-1165C) **Design and performance of silicon solar cells under concentrated sunlight.** Weaver, H.T.; Nasby, R.D. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 4p. (CONF-790541—39). Dep. NTIS, PC A02/MF A01.

From International Solar Energy Society meeting; Atlanta, GA, USA (28 May 1979).

Measurements and numerical calculations of performance of silicon solar cells, designed for operation under concentrated sunlight, are presented. Two design strategies are discussed and data from cells of each type are used for comparison with theory. The calculations ignore degeneracy and high doping effects but include Auger and trap recombination. Experimental base lifetimes are used for modeling. Agreement between calculations and experiment is within 5 to 10 percent.

48287 (SU-DMS—78-R-2) **Photoelectronic properties of II-VI heterojunctions. Progress report No. 3, March 1, 1978—February 28, 1979.** Bube, R.H. (Stanford Univ., CA (USA). Dept. of Materials Science and Engineering). 1979. Contract EY-76-S-03-0326-047. 131p. Dep. NTIS, PC A07/MF A01.

Research on four principal problem areas is described in detail: (1) properties of heterojunctions formed by rf sputtering of indium—tin oxide (ITO) on single crystal p-type CdTe, together with information on CdTe surfaces and In/CdTe Schottky barriers; (2) the preparation of ZnO films by spray pyrolysis with good optical and electrical properties for the preparation of ZnO/CdTe heterojunctions; (3) the comparison of properties of Cu/sub x/S/CdS heterojunctions prepared by the dry process on thin-film CdS substrates with those prepared on single-crystal CdS substrates; and (4) initial exploration of electron microscopy of InSb/CdTe heterojunctions.

48288 **Solar panel with removable cell matrix, and method of making same.** Lindmayer, J. (to Solarex Corp.). US Patent 4,139,399. 13 Feb 1979. Filed date 18 Jan 1978. 6p.

A solar panel is formed with a frame defining channels adapted to receive and retain a solid body of resin therein. The body of resin forms a matrix that encapsulates photovoltaic cells. Part of the frame may be disassembled to permit the matrix to be inserted into or removed from the channels.

48289 **Solar cell with a gallium nitride electrode.** Pankove, J.I. (to RCA Corp.). US Patent 4,139,858. 13 Feb 1979. Filed date 12 Dec 1977. 4p.

A solar cell is described which comprises a body of silicon having a P-N junction therein with a transparent conducting N-type gallium nitride layer as an ohmic contact on the N-type side of the semiconductor exposed to solar radiation.

48290 **Constant voltage solar cell and method of making same.** Lindmayer, J. (to Solarex Corp.). US Patent 4,137,095. 30 Jan 1979. Filed date 9 May 1977. 6p.

A silicon solar energy cell producing electricity at substantially constant voltage despite significant increases in illumination is described in which the back surface junction of the cell is formed by alloying with gallium.

48291 **Low cost system for developing solar cells.** Maier, H.B. US Patent 4,137,096. 30 Jan 1979. Filed date 3 Mar 1977. 8p.

Low cost solar cells are made by electrodeposition of a metallic coating on a conductive substrate, followed by cathodic conversion of the coating in a thiosulfate containing bath to form metallic sulfides. Electrical contacts are made to portions of the sulfide layer and the coated substrate is dried to a point sufficient to yield a photoresponsive device.

48292 **Solar energy window.** Field, R.L. (to Dept. of the Navy). US Patent 4,137,098. 30 Jan 1979. Filed date 20 Oct 1977. 4p.

An energy absorbing venetian blind type device for generating electricity, providing heat, and serving as a sun shade is described. A plurality of slats covered with an array of photovoltaic cells are enclosed between two panes of glass of a window housing. A heat removal system using forced air cools the photovoltaic cells and collects heat for heating purposes elsewhere. The electricity generated by the photovoltaic cells is collected for immediate use or stored in storage batteries for later use.

48293 **Solar energy assembly.** Kelly, J.E. US Patent 4,137,097. 30 Jan 1979. Filed date 15 Aug 1977. 4p.

A solar energy collector and heat exchanger assembly is described comprising a housing having a transparent top, a transparent wall within the housing parallel to the top to divide the housing into upper and lower chambers, the upper chamber having an air inlet and an air outlet, the lower chamber having a liquid inlet interconnected by a conduit to a liquid outlet, photo cells disposed in the lower chamber and adapted to provide heat to the conduit, and reflector structure disposed in the lower chamber for directing sunlight to the photo cells and for reflecting sunlight to the upper chamber.

48294 **Light energy conversion.** Kilby, J.S.; Lathrop, J.W.; Porter, W.A. (to Texas Instruments Inc.). US Patent 4,136,436. 30 Jan 1979. Filed date 2 Dec 1976. 12p.

A process for the manufacture of a light energy converter involves forming of a plurality of photovoltaic sources wherein first bodies of a first conductivity type semiconductor material each has a surface layer of a second conductivity type material and second bodies of said second conductivity type semiconductor material each has a surface layer of said first conductivity type material. The first and second bodies are intermingled in a one level layer in an

insulating support. A conductive layer is applied to interconnect the first conductivity type material of all said first bodies with the second conductivity type material of all said second bodies. An electrolyte may wet such sources where, upon exposure to light, the sources cause a current to flow in the electrolyte producing an electrochemical reaction. The products of this reaction where the electrolyte is a solution such as aqueous hydrogen iodide, and the hydrogen produced by the electrochemical reaction may be stored, burned as a fuel or used in a fuel cell to produce electrical energy.

48295 Shaped edge solar cell coverslide. Meulenberg, A. Jr. (to Communications Satellite Corp.). US Patent 4,133,699. 9 Jan 1979. Filed date 26 Apr 1978. 6p.

A solar cell coverslide, oversized to protect the cell against damage from radiation, is modified to have an edge portion configured to bend light incident on said edge portion inwardly toward an underlying solar cell. An adhesive fillet may be formed between the undersurface of the overhanging portion of the coverslide and the top edge of the solar cell to facilitate further the transmission of light striking the configured edge portion into the solar cell.

48296 Tandem junction solar cell. Chiang, S.Y.; Carbajal, B.G. (to Texas Instruments Inc.). US Patent 4,133,698. 9 Jan 1979. Filed date 27 Dec 1977. 4p.

A solar cell having first and second closely spaced, parallel P-N junctions is fabricated, wherein the illuminated surface is totally free of metallization, i.e., the junction nearest the illuminated surface is not electrically connected, and thereby participates only indirectly in the collection of photo-generated carriers by providing a charge field to suppress the front surface recombination and to enhance collection at the back side junction. All metallization is on the back side, which preferably includes an interposed finger pattern of N+ and P+ zones.

48297 Method of semiconductor solar energy device fabrication. Lesk, I.A.; Pryor, R.A. (to Motorola, Inc.). US Patent 4,131,488. 26 Dec 1978. Filed date 25 Apr 1977. 8p.

This disclosure relates to a semiconductor solar energy device which is of the PN-type and utilizes a dielectric anti-reflective coating on the side of the device that faces the sunlight. The fabrication techniques used in making this semiconductor device include the use of a rough or textured pyramid shaped silicon surface beneath the anti-reflective coating to increase solar cell efficiency. Also, ion implantation is used to form the PN junction in the device. The ion implanted region located on the side of the device that is subjected to the sunlight is configured in order to permit metal ohmic contact to be made thereto without shorting through the doped region during sintering of the metal contacts to the semiconductor substrate. The dielectric anti-reflective coating, in one embodiment, is a composite of silicon dioxide and silicon nitride layers. The device is designed to permit solder contacts to be made to the P and N regions thereof without possibility of shorting to semiconductor regions of opposite type conductivity.

48298 Interconnection for photovoltaic device array. Keeling, M.C.; Bailey, W.L; Coleman, M.G.; Lesk, I.A.; Pryor, R.A. (to Motorola, Inc.). US Patent 4,131,755. 26 Dec 1978. Filed date 17 Jun 1977. 8p.

An interconnection system is described for interconnecting a plurality of photovoltaic devices. The photovoltaic devices each have a first and a second side and the interconnect system is located on the second side of the photovoltaic devices. A sheet of dielectric material and a sheet of electrically conductive material are bonded together and positioned so that the dielectric material is next to the photovoltaic devices. A plurality of patterns are formed in the sheet of electrically conductive material. The patterns each have angled tabs punched therein so that the angled tabs are punched through both the electrically conductive material and the dielectric material. When a photovoltaic device is positioned within a group of angled tabs, the angled tabs can be brought into contact with electrical contacts on the first side of the photovoltaic device. The group of angled tabs are electrically common to a part of the pattern which has an extended portion which extends beneath an adjacent photovoltaic device. Some of the dielectric material is removed from the extended portion so that this portion then makes contact with the second side of an adjacent photovoltaic device. The patterns can be formed in predetermined configurations to provide series or series-parallel interconnections for photovoltaic devices within an array of photovoltaic devices. The interconnect system, in turn, provides for substantially all possible series, parallel, or series-parallel interconnections of a plurality of arrays.

48299 Back wall solar cell. Brandhorst, H.W. Jr. (to National Aeronautics and Space Administration). US Patent 4,131,486. 26 Dec 1978. Filed date 24 Apr 1978. 6p.

The application discloses a back-well cell, for example, a solar cell which comprises a first semiconductor material of one conductivity type with one face having the same conductivity type but more heavily doped to form a field region arranged to receive the radiant energy to be converted to electrical energy, and a layer of a second semiconductor material, preferably highly doped, of opposite conductivity type on the first semiconductor material adjacent the first semiconductor material at an interface remote from the heavily doped field region. Instead of the opposite conductivity layer, one may employ a metallic layer to form a Schottky diode. If the metallic Schottky diode layer is used, no additional back contact is needed. A contact such as a gridded contact, pervious to the radiant energy may be applied to the heavily doped field region of the more heavily doped, same conductivity material for its contact.

48300 Solar cell module and method of making same. Della-Vedowa, R.P.; Shahryar, I.M. (to Solec International, Inc.). US Patent 4,131,123. 26 Dec 1978. Filed date 13 Jan 1977. 6p.

A solar cell module and method of making same are described characterized by a plurality of solar cell discs or wafers first disposed between opposite faces of an electrically insulating sheet of the same thickness as the wafers, and thence printed on both sides with electrical conducting material to provide a positive conducting face on one side of all wafers and integral solderless printed conductors between adjacent wafers and a negative grid on the other side of all wafers and integral solderless printed conductors between adjacent wafers. When the wafers are series connected, apertures are provided in the sheet through which the printing material extends to series connect adjacent wafers. The wafers may be secured within the sheet by securing same within apertures therein or elongated crystals may be disposed in a mold and electrically insulating material may be cast there-around to form a block which may then be sliced into modules.

48301 Stable solar power source for portable electrical devices. Grazier, J.A.; Grazier, L.F. US Patent 4,122,396. 24 Oct 1978. Filed date 18 Feb 1976. 8p.

The stable solar power source consists of solar cells for converting sunlight into electrical energy and a large capacitor for providing a current reserve to satisfy peak current demands and offset the effects of sunlight variations. The solar cells are mounted beneath a light transmitting thermal shield to minimize thermal induced cell output variations.

48302 Solar panel with mat base member. Dominguez, R. (to Solarex Corp.). US Patent 4,116,207. 26 Sep 1978. Filed date 12 Jul 1977. 4p.

A solar panel is described including photovoltaic cells encapsulated in a silicone resin, in which the base member to which the silicone resin adheres is a glass mat polyester in laminate or molded form.

48303 (TID—28842(Draft)) **Commercialization strategy report for photovoltaic systems.** Morse, F.H.; Card, M.; Lewis, R.; Maycock, P.; Smith, E.; Taylor, S. (Department of Energy, Washington, DC (USA)). [nd]. 40p. Dep. NTIS, PC A03/MF A01.

The commercialization readiness of photovoltaics is discussed including technical readiness, market/economic readiness, environmental readiness, institutional readiness, and benefits analysis. Possible government actions addressing the barriers to market development are described. Two generic commericalization strategies for achieving DOE array price and production volume goals are outlined. (WHK)

BIOMASS PRODUCTION AND CONVERSION

REFER ALSO TO CITATION(S) 48255, 48749

48304 (COO—5022-5) **Research and evaluation of biomass resources/conversion/utilization systems (market/experimental analysis for development of a data base for a fuels from biomass model). Quarterly technical progress report, January 1—March 31, 1979.** Ahn, Y.K.; Brumberg, R.J.; Chen, H.C.; Nelson, E.T.; Stringer, R.P.; Bailie, R.C. (Gilbert Associates, Inc., Reading, PA (USA); Environmental Energy Engineering, Inc., Morgantown, WV (USA)). 1979. Contract ET-78-C-02-5022. 23p. Dep. NTIS, PC A02/MF A01.

The progress made in the development of a linear programming model which will enable the energy manager to determine the right mix of biomass resources and conversion processes to produce the desired fuel is summarized. In the development of the model, a market analysis of the need for biomass derived fuels will be made and the regional availability of biomass resources determined on a seasonal basis. Biomass conversion profiles (gasification, pyrolysis, and direct combustion) will be developed for 100 biomass materials. (JSR)

48305 (SAN—0115-T1) **Mission analysis for the Federal fuels from biomass program. Volume III. Feedstock availability. Final report.** Ernest, R.K.; Hamilton, R.H.; Borgeson, N.S.; Schooley, F.A.; Dickenson, R.L. (SRI International, Menlo Park, CA (USA)). Jan 1979. Contract EY-76-C-03-0115-131. 79p. Dep. NTIS, PC A05/MF A01.

The biomass supply in the United States was estimated as a function of delivered price through the year 2020. The biomass supply represents the combined tonnages of agricultural, logging, and mill residues; other forest residues; and energy crop output. Two scenarios were used for the projections: a base case and an optimistic case reflecting increases in land and water availability for production of energy crops resulting from an array of government incentives. An appendix tabulates the feedstock availability by region, type, price, year, and scenario. (JSR)

48306 (SLU-IEM—73-1978) **Tree biomass in some Scots pine stands.** Albrektsson, A. (Sveriges Lantbruksuniversitet, Uppsala. Inst. foer Ekologi och Miljoevaard). 1978. 22p. (In Swedish). Dep. NTIS (US Sales Only), PC A02/MF A01.

The biomass of the tree layer was estimated in a number of pine stands (Pinus silvestris L.) in northern Gaestrikland, Sweden. These investigations formed part of the Swedish Coniferous Forest Project. The stands were growing under similar conditions, and were selected so as to form an age sequence. Biomass was estimated by destructive sampling of trees. The dry weights of the following fractions per hectare are given: roots > 30 mm diameter, stumps, stems, branches, and dead branches.

PHOTOCHEMICAL AND THERMOCHEMICAL CONVERSION

48307 (STU—75-3605) **Photochemical reduction of carbon dioxide.** Aakermark, B. (Styrelsen foer Teknisk Utveckling, Stockholm (Sweden)). Nov 1978. 5p. (In Swedish). (STU—74-3725). Dep. NTIS (US Sales Only), PC A02/MF A01.

Projects concerning the utilization of renewable energy sources are at present given high priorities. Some of these projects are dealing with problems in connection with long-time storage of solar energy as fuels, for instance hydrogen gas. These types of projects are of great interest in Sweden since the energy demand increases of course when the solar flux decreases. The reduction of carbon dioxide is an attractive method to produce fuels. The most common reduction products are methanol, methane, formaldehyde and formic acid. In the present work the carbon dioxide is photochemically reduced by admitting carbon dioxide into acid solution of different metal ions for instance iron, cobalt and chromium and at the same time irradiate the solution by ultraviolet radiation. All the reduction products mentioned above were obtained.

48308 **Photoelectrochemical energy storage system.** McKinzie, H.; Wrighton, M.S.; Lester, J. (to GTE Laboratories, Inc.). US Patent 4,128,704. 5 Dec 1978. Filed date 14 Nov 1977. 8p.

A photochemical energy storage system includes at least one electrolytic solution containing a reduction-oxidation couple, one species of which can be stored in a second phase. The device includes a charging system and an energy delivery system. The charging system includes an n-or p-type photosensitive electrode at which, under illumination, an oxidation or reduction reaction occurs. In the charging cycle, one species is oxidized while the other is reduced, and one of these products is stored in a phase other than the phase in which the reaction occurs. The energy delivery system transfers electrons to or from the high energy product on demand for delivery through an electrical load to an electrode at which the original reactants can be reconstituted.

48309 **Light energy conversion.** Kilby, J.S.; Lathrop, J.W.; Porter, W.A. US Patent 4,100,051. 11 Jul 1978. Filed date 2 Dec 1976. 14p.

Solar energy conversion is provided by a structure formed of a plurality of photovoltaic sources. An electrolyte wets the sources. Upon exposure to light the photovoltaic sources cause a current to flow in the electrolyte, producing an electrochemical reaction. The products of this reaction are collected and stored. In a preferred embodiment the electrolyte is an aqueous solution of hydrogen iodide, and the hydrogen produced by the electrochemical reaction may be stored, burned as a fuel or used in a fuel cell to produce electrical energy.

PHOTOVOLTAIC POWER PLANTS

REFER ALSO TO CITATION(S) 48269, 48282

48310 (SAND—79-1126C) **Design of photovoltaic systems for intermediate-sized applications.** Burgess, E.L.; Jones, G.J. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 7p. (CONF-790803—33). Dep. NTIS, PC A02/MF A01.

From 14. intersociety energy conversion conference; Boston, MA, USA (5 Aug 1979).

Several detailed design studies have been performed this past year for photovoltaic (PV) systems for intermediate load-center applications. The applications are representative of the commercial and industrial sectors. The designs have included total-energy systems, ac and dc loads, energy storage, utility feedback, and stand-alone configurations. The design techniques are reviewed, and resulting subsystem requirements are discussed. Three designs are discussed in detail to illustrate the use of the design techniques. Conclusions concerning future economic viability and technology development needs are presented.

SOLAR THERMAL POWER PLANTS

REFER ALSO TO CITATION(S) 48265, 48269

48311 (DOE/JPL/1060—4) **Techno-economic projections for advanced small solar thermal electric power plants to years 1990—2000.** Fujita, T.; Manvi, R.; Roschke, E.J.; El Gabalawi, N.; Herrera, G.; Kuo, T.J.; Chen, K.H. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Nov 1978. Contract EX-76-A-29-1060. 164p. (JPL-PUB—79-25). Dep. NTIS, PC A08/MF A01.

Advanced technologies applicable to solar thermal electric power systems in the 1990—2000 time-frame are delineated for power applications that fulfill a wide spectrum of small power needs with primary emphasis on power ratings <10 MWe. Techno-economic projections of power system characteristics (energy and capital costs as a function of capacity factor) are made based on development of identified promising technologies. The key characteristic of advanced technology systems is an efficient low-cost solar energy collection while achieving high temperatures for efficient energy conversion. Two-axis tracking systems such as the central receiver or power tower concept and distributed parabolic dish receivers possess this characteristic. For these two basic concepts, advanced technologies including, e.g., conversion systems such as Stirling engines, Brayton/Rankine combined cycles and storage/transport concepts encompassing liquid metals, and reversible-reaction chemical systems are considered. In addition to techno-economic aspects, technologies are also judged in terms of factors such as developmental risk, relative reliability, and probability of success. Improvements accruing to projected advanced technology systems are measured with respect to current (or pre-1985) steam-Rankine systems, as represented by the central receiver pilot plant being constructed near Barstow, California. These improvements, for both central receivers and parabolic dish systems, indicate that pursuit of advanced technology across a broad front can result in post-1985 solar thermal systems having the potential of approaching the goal of competitiveness with conventional power systems; i.e., capital costs of $600 kWe and energy costs of 50 mills/kWe-hr (1977 dollars).

48312 (DOE/JPL/1060—6) **Advanced subsystems development. Second semi-annual progress report, April 1—October 1, 1978.** (Jet Propulsion Lab., Pasadena, CA (USA); National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 15 Nov 1978. Contract EX-76-A-29-1060. 244p. (JPL-PUB—79-24). Dep. NTIS, PC A11/MF A01.

The concept design for a small (less than 10 MWe) solar thermal electric generating plant was completed using projected 1985 technology. The systems requirements were defined and specified. The components, including an engineering prototype for one 15 kWe module of the generating plant, were conceptually designed. Significant features of the small solar thermal power plant were identified as the following: (1) 15-kWe Stirling-cycle engine/alternator with constant power output; (2) 10-meter point-focusing paraboloidal concentrator with cantilevered cellular glass reflecting panels; (3) primary heat pipe with 800°C output solar cavity receiver; (4) secondary heat pipe with molten salt thermal energy storage unit; (5) electric energy transport system; and (6) advanced battery energy storage capability. The present emphasis for achieving cost reduction goals centers on improving conversion efficiency and reducing the cost of key components.

48313 (DOE/JPL/1060—78/2(Rev.1)) **Sitting issues for solar thermal power plants with small community applications. Thermap power plants: Small Power Systems Application Project.** Holbeck, H.J.; Ireland, S.J. (Jet Propulsion Lab., Pasadena, CA (USA)). 1 Feb 1979. Contract EX-76-A-29-1060. 44p. (JPL-PUB—78-75(Rev.1)). Dep. NTIS, PC A03/MF A01.

The siting issues associated with small, dispersed solar thermal power plants for utility/small community applications of less than 10 MWe are considered. Some specific requirements refer to the first engineering experiment for the Small Power Systems Applications (SPSA) Project. The introductory section describes the SPSA Project and the requirements for the first engineering experiment and gives the objectives and scope for the report as a whole. A brief overview of solar thermal technologies is followed by a discussion of some technology options. The siting issues themselves are discussed in the remainder of the report in three categories: (1) system resource requirements, (2) environmental effects of the system, and (3) potential impact of the plant on the environment.

Within these categories, specific issues are discussed in a qualative manner. Examples of limiting factors for some issues are taken from studies of other solar systems.

48314 (LBL—8520) **New solar thermal receiver utilizing a small particle heat exchanger.** Hunt, A.J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Apr 1979. Contract W-7405-ENG-48. 17p. (CONF-790803—32). Dep. NTIS, PC A02/MF A01.

From 14. intersociety energy conversion conference; Boston, MA, USA (5 Aug 1979).

A dispersion of small absorbing particles forms an ideal system to collect radiant energy from concentrated sunlight to heat a pressurized gas that when expanded through a turbine will produce useful mechanical energy. A new type of solar thermal receiver based on this concept is being developed at LBL that is to be placed at the focus of a central tower or a parabolic dish concentrator system. An open cycle Brayton heat engine utilizing a Small Particle Heat Exchange Receiver (SPHER) operates by compressing ambient air and injecting a very small mass of fine particles into the gas stream. The air particle mixture enters a transparent heating chamber where the solar flux is concentrated. The particles absorb the radiation and because of their very large surface area, quickly release the heat to the surrounding gas. The air-particle mixture continues to heat until the particles vaporize. The optical efficiency of the receiver is 85 to 90% without a cavity and the thermodynamic efficiency of the Brayton cycle is greater than 40%. Calculations of the optical, thermal, and physical processes have been performed; candidate receiver designs and window materials have been determined; and the feasibility demonstrated in the laboratory.

48315 (SAND—78-1315(Rev.)) **User's manual for computer code SOLTES-1 (simulator of large thermal energy systems).** Fewell, M.E.; Grandjean, N.R. (Sandia Labs., Albuquerque, NM (USA)). Jun 1979. Contract EY-76-C-04-0789. 318p. Dep. NTIS, PC A14/MF A01.

SOLTES simulates the steady-state response of thermal energy systems to time-varying data such as weather and loads. Thermal energy system models of individual components and simple and complex systems can easily be modularly constructed from a library of routines. These routines mathematically model solar collectors, pumps, switches, thermal energy storage, thermal boilers, auxiliary boilers, heat exchangers, extraction turbines, extraction turbine/generators, condensers, regenerative heaters, air conditioners, process vapor, etc; SOLTES also allows user-supplied routines. Fluid names need only be specified in order to instruct SOLTES to obtain the proper constants from a fluid property data blank. Load management allows SOLTES to simulate total energy systems that simultaneously follow process heat and power loads and demands. Power, heating, and/or cooling requirements of each component in the system model can be satisfied by other components in the system or externally. Cooling, heating, electrical, mechanical, thermal, and/or hot-water loads may be read from a data file, combined by category, scaled and/or peak-shaved, and followed. Hourly weather data for typical meteorological years for 26 locations in the US are used, or the user can supply weather data with any time increment. Generalized energy accounting is available and instantaneous and integrated values for system performance parameters may be automatically determined. In addition to other data, system performance and energy accounting parameters may be written to a file for access by user-supplied programs for economic, rate, or auxiliary supply analyses, etc. Because of its modularity and flexibility, SOLTES can be used to simulate a wide variety of thermal energy systems such as solar power/total energy, fossil-fired power plants/total energy, nuclear-fired power plants/total energy, solar energy heating and cooling, geothermal energy, and solar hot water.

48316 **Solar heat supplemented convection air stack with turbine blades.** Polyak, J. US Patent 4,122,675. 31 Oct 1978. Filed date 17 Mar 1977. 6p.

A high rise building is provided including upstanding peripheral wall portions and at least one of the peripheral wall portions includes an upstanding air flow passage extending therealong. Horizontally outwardly projecting and downwardly opening hollow snout-like shrouds define air inlets opening outwardly and downwardly along the one upstanding peripheral wall portion and inwardly into the air flow passage at points spaced vertically therealong. A rotary turbine including an inlet and outlet is supported from an upper portion of the building and the upper end portion of the air flow passage is communicated with the inlet of the turbine. The turbine includes a rotary output shaft and a generator is driven from the rotary output shaft of the turbine for generating electrical current.

CENTRAL RECEIVER

48317 (DOE/JPL/1060—13) **HEAP: heat energy analysis program. A computer model simulating solar receivers.** Lansing, F.L. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Jan 1979. Contract EX-76-A-29-1060. 138p. (JPL-PUB—79-3). Dep. NTIS, PC A07/MF A01.

Thermal design of solar receivers is commonly accomplished via approximate models, where the receiver is treated as an isothermal box with lumped quantities of heat losses to the surroundings by radiation, conduction and convection. These approximate models, though adequate for preliminary design purposes, are not detailed enough to distinguish between different receiver designs, or to predict transient performance under variable solar flux, ambient temperatures, etc. A computer code has been written for this purpose and is given the name HEAP, an acronym for Heat Energy Analysis Program. HEAP has a basic structure that fits a general heat transfer problem, but with specific features that are custommade for solar receivers. The code is written in MBASIC computer language. This document explains the detailed methodology followed in solving the heat transfer problem, and includes a program flow chart, an explanation of input and output tables, and an example of the simulation of a cavity-type solar receiver.

48318 (SAND—79-8215) **User's manual for DELSOL: a computer code for calculating the optical performance, field layout, and optimal system design for solar central receiver plants.** Dellin, T.A.; Fish, M.J. (Sandia Labs., Livermore, CA (USA)). Jun 1979. Contract EY-76-C-04-0789. 195p. Dep. NTIS, PC E05/MF E01.

DELSOL is a quick and accurate computer program for calculating the collector field performance, field layout, and optimal system design for solar central receiver plants. The code consists of a detailed model of the optical performance, a simpler model of the non-optical performance, an algorithm for field layout, and a searching algorithm to find the best system design. The latter two features are coupled to a cost model of central receiver components and an economic model for calculating energy costs. The code can handle flat, focused and/or canted heliostats, and external cylindrical, multi-aperture cavities, and flat plate receivers. The program optimizes the tower height, receiver size, field layout, and power level.

48319 **System for solar radiation energy collection and conversion.** Korr, A.L. (to A.L. Korr Associates, Inc.). US Patent 4,136,674. 30 Jan 1979. Filed date 28 Jul 1977. 10p.

A solar radiation energy collecting system is described for receiving the sun's rays and focusing them upon a central absorber. A plurality of plane mirrors are mounted in a circular array concentric with a vertical absorber tower, the azimuth angle of each of the mirrors being fixed in the array at the particular angle necessary for it to reflect rays from the sun upon the absorber tower. The mirror array is mounted upon a boat floating on a pond and the boat and mirror array rotated in synchronism with the daily apparent motion of the sun, so as to maintain the desired focusing of reflected solar radiation upon the absorber tower. In one simple embodiment the mirrors are rotated only in a horizontal plane about the vertical axis of the absorber tower, and the varying elevation angles of the sun cause the reflected solar energy to scan up and down along the length of the absorber tower as the sun moves from east to west each day. The absorber tower preferably comprises conduits for delivering fluid to be heated into parts of the tower impinged by the reflected solar radiation energy, and for removing the heated fluid from the tower to a location at which the absorbed heat energy is to be utilized. In some cases the part of the boat not occupied by the above-identified mirrors may be substantially covered with horizontal trough-like reflectors having heat absorbing members disposed along their respective aligned foci, so as to obtain useful solar energy collection from this latter portion of the rotating boat assembly. In other cases the plane-mirror array may be continued around the entire circumference of the boat, especially where the apparatus is utilized in positions near the equator.

48320 (SAND—79-6000) **Use of solar energy for the production of electricity in the alps.** Newman, P. (Battelle Memorial Inst., Geneva (Switzerland)). Jan 1979. Translation of Serie de publications de la Commission federale de la conception globale de l'energie, Etude No. 7, October 1976. 48p. Dep. NTIS, PC A03/MF A01.

Means of converting solar energy into electricity are briefly reviewed. Applications of solar energy technology to meet the increasing demand for electricity in Switzerland are considered. A description and discussion of central tower and heliostat field systems is presented. Details concerning steam cycles and solar boilers, turboalternator units and heat exhaust systems, daily and seasonal power variations of a solar plant, and effects on energy output due to cloudiness are considered. Meteorological data for the evaluation of possible solar generating sites is discussed and the solar potential of the Alps is analyzed. Integration of solar plants into the existing power grid is discussed. The economic and environmental impacts of solar power plants are considered in detail and a development program is suggested.

TOTAL ENERGY AND HYBRID SYSTEMS

REFER ALSO TO CITATION(S) 48459

48321 (ALO—3994-77/3) **Solar total energy-large scale experiment, Shenandoah, Georgia site. Annual report, June 1977—June 1978.** (Georgia Power Co., Atlanta (USA)). Jun 1978. Contract EG-77-A-04-3994. 193p. Dep. NTIS, PC A09/MF A01.

The site was described in terms of location, suitably, accessibility, and other factors. Detailed descriptions of the Solar Total Energy-Large Scale Experiment Application (STE-LSE) (Bleyle of America, Inc., Knitwear Plant), the DOE owned Meteorology Station operating at the site, and the instrumentation provided by the Georgia Power Company to measure energy usage within the knitwear plant are included. A detailed report of progress is given at the Shenandoah Site, introduced by the STE-LSE schedule and the Cooperative Agreement work tasks. Progress is described in terms of the following major task areas: site/application; instrumentation/data acquisition; meteorology station; site to STES interface; information dissemination. A brief overview of milestones to be accomplished is given, followed by these appendices: solar easement agreement, interface drawing set, and additional site background data. (MHR)

48322 (SAND—79-0422) **Methodology for determining the configuration of the optimum Solar Total Energy System.** Peters, R.R. (Sandia Labs., Albuquerque, NM (USA)). May 1979. Contract EY-76-C-04-0789. 59p. Dep. NTIS, PC A05/MF A01.

A methodology for determining the configuration of the most economical Solar Total Energy System (STES) for a particular application is presented. This methodology also can be used to design Small Power Systems and Solar Process Heat Systems because they are special cases of a STES. Since the values of the economic parameters used in this analysis are not well-defined, restrictions can be placed on the amount of purchased electricity and fossil fuel. Using these restrictions, one can design, for example, the most economical STES which purchases one-fourth as much energy as a conventional system. The results of the analysis include the system design, its performance, annualized cost, etc., and polynomials which can be used to determine system cost and energy purchases at off-optimum design points. The results of an investigation of an application similar to the Bleyle Plant in Shenandoah, Georgia (the site of Large Scale Experiment No. 2), are presented. The sensitivity of the results to changes in the energy inflation rates, the electricity pricing schedule, system location, and restrictions on the amount of purchased energy are investigated. The results indicate a STES which starts operation in 1982 is competitive for this application. In many cases it is less expensive than a conventional system which purchases all of the electricity and fossil fuel required to satisfy the application's demands. These results are based upon high production rate costs for the major components.

OCEAN THERMAL GRADIENT POWER PLANTS

REFER ALSO TO CITATION(S) 48268

48323 (ANL/OTEC-BCM—003) **Qualification of aluminum for OTEC heat exchangers.** LaQue, F.L. (Argonne National Lab., IL (USA)). May 1979. Contract W-31-109-ENG-38. 32p. Dep. NTIS, PC A03/MF A01.

The basis for qualification of aluminum as a material for use as tubing in Ocean Thermal Energy Conversion heat exchangers is reviewed. Reference is made to compendia of data from tests of aluminum alloys in natural sea water and to applicable service records. Data from these sources were found to be inadequate to either qualify or disqualify aluminum. They serve only to identify the 5052 alloy and Alclad 3003 or 3004 as being worthy of additional testing under conditions more directly related to what will be encountered in OTEC heat exchangers. The principal deficiency of data from long-time tests in natural sea water is that in almost all of these tests the specimens were exposed under static conditions that caused the surfaces to be covered by marine fouling organisms that would not be present in heat exchanger tubes. The tests did not take into account possible effects of periodic mechanical or chemical treatments to remove fouling or chemical treatments (chlorination) to prevent fouling. A current testing program sponsored by the Department of Energy through Argonne National Laboratory is designed to provide the needed data. Limited tests in high velocity sea water have indicated that aluminum tubes would tolerate the velocities under 10 ft (3 m) per second likely to be used in OTEC heat exchangers.

48324 (ANL/OTEC-BCM—004) **Study of the corrosive effect on aluminium and CP titanium of mixtures of ammonia and seawater that may be encountered in OTEC heat exchangers. Final report.** Schrieber, C.F.; Grimes, W.D.; McIlhenny, W.F. (Dow Chemical U.S.A., Freeport, TX. Texas Div.). Mar 1979. Contract W-31-109-ENG-38. 121p. Dep. NTIS, PC A06/MF A01.

The design currently most favored for an Offshore Thermal Energy Conversion power plant would use an ammonia cycle energy system as powered by the small thermal differences existing between warm surface and deep ocean waters. A possibility therefore exists for ammonia or seawater leakage within the evaporator or condenser. The objective of this work is to assess the extent to which small concentrations of seawater would affect corrosion of aluminum and CP titanium by ammonia and the extent to which small concentrations of ammonia might affect the same alloys by seawater. Testing was conducted using coupons of aluminum alloys 3003-H14, 5052-H32, and 5086-H32, CP titanium, and aluminum alloy 5052-H32 as pretreated for 8 hours in boiling deionized water. Four pilot units were constructed to investigate different possible OTEC heat exchanger environments. Experimentation on ammonia leakage into seawater employed two units containing recirculating (~ 6 gal.), temperature-controlled (5°C or 30°C) seawater at 5.6 and 2.5 fps with continuous seawater refreshment (2.0-0.5 gpm). Ammonia leakage was simulated in these two units by injection of ammonia hydroxide into the refreshment seawater. A third unit with the same seawater supply utilized seawater on a once-through, 5 fps, ambient temperature basis to simulate optimum, no-leak OTEC seawater service. Performance of the subject alloys in ammonia and ammonia containing seawater utilized recirculating ammonia with temperature controlled to 5°C. The experimental procedure and test results are discussed.

48325 (ANL/OTEC-BCM—005) **Review of water intake screening options for coastal water users with recommendations for Ocean Thermal Energy Conversion (OTEC) plants.** Thomas, D.L. (Ichthyological Associates, Inc., Absecon, NJ (USA)). May 1979. Contract W-31-109-ENG-38. 43p. Dep. NTIS, PC A03/MF A01.

The large volumes of water withdrawn at both the warm and cold water intakes of an OTEC plant must be screened to remove organisms and debris which could clog the heat exchangers. The recent literature on screening technology is reviewed. In addition, various screen manufacturers and coastal facilities which use large volumes of seawater were visited to determine the operating experience with present screen technology. Static screens (particularly the Johnson Division, UOP profile wire screen and the Royce Equipment Company carrousel screen) have the potential advantage for OTEC for operating in a completely submerged state and of being cheaper to operate and maintain than traveling screens. However, there is no operational history with these static screens for large intake systems. The most promising traveling screen options for OTEC are the dual flow screens. They offer more screening surface and less head loss than through flow screens of similar size. They also have been operated in seawater for large intake systems. More detailed designs of potential OTEC plants, particularly screen wells, conduit and surge tank construction and head losses need to be determined before the best alternative intake screen can be selected. 38 references.

48326 (CONF-780236—P2, pp IV.15-IV.76) **OTEC ocean systems evaluation.** Basar, N.S.; Daidola, J.C.; Maniar, N.M. (M. Rosenblatt & Son, Inc., New York, NY). Sep 1978.
From 5. OTEC conference; Miami, FL, USA (20 Feb 1978).

Work performed on the OTEC Pilot Plant and Commercial Plant feasibility and evaluation studies was presented. The initial 5 MW/sub e/ test platform (EOTP-5) studies were performed specifically with the purpose of screening a number of existing vessels and selecting the most feasible vessel to be used as a candidate for the conversion. These initial studies were later expanded for the revised objective of installing two 5 MW/sub e/ plants on the candidate vessel. The candidate vessel from the first phase of the study was bulk carrier of 50 to 80,000 DWT capacity. In the second stage of the pilot plant study, the feasibility of using a bulk carrier type vessel with integral and detached cold water pipes was investigated and cost/time schedules for the most feasible candidates were developed. The commercial OTEC platform studies consisted of investigating six generic hull shapes, specified by the U.S. Department of Energy, and any other feasible hull shapes. As the first phase of this study, a methodology was to be developed for use in evaluating these platforms and their ocean systems, and in determining their ranking as potential OTEC candidates. The results of the two studies for the pilot and commercial plant are summarized and discussed.

48327 (DTNSRDC—79/054) **Corrosion and biofouling on the non-heat-exchanger surfaces of an ocean thermal energy conversion power plant: a survey.** Castelli, V.J. (ed.). (David W. Taylor Research and Development Center, Bethesda, MD (USA)). May 1979. Contract EY-76-C-06-1830. 106p. Dep. NTIS, PC A06/MF A01.

Of the many foreseeable problems confronting economical ocean thermal energy conversion operation, two major items are the deterioration of the structural and functional components, which prevents efficient operation, and the biofouling of the surfaces, which adds excess weight to the floating ocean platform. The techniques required for effective long-term control of deterioration and corrosion have been investigated actively for many years, and successful solutions for most situations have been developed. For the most part, these solutions can be directly transferred to the ocean

thermal energy conversion plant. The majority of problems in these areas are expected to be associated with scale-up and will require some advanced development due to the immensity of the ocean thermal energy conversion platform. Current antifouling control systems are not effective for long-term fouling prevention. Commercially available antifouling coatings are limited to a 3-year service life in temperate waters, and even shorter in tropical waters. However, underwater cleaning techniques and some fouling-control systems presently being used by conventional power plants may find utility on an ocean thermal energy conversion plant. In addition, some recent major advances in long-term antifouling coatings sponsored by the Navy may be applicable to ocean thermal energy conversion. 132 references.

48328 (LBL—9052) **Comparison of nutrient data from four potential OTEC sites.** Quinby-Hunt, M.S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1979. Contract W-7405-ENG-48. 8p. (CONF-790631—7). Dep. NTIS, PC A02/MF A01.

From 6. OTEC conference; Washington, DC, USA (19 Jun 1979).

An in-progress assessment of nutrient chemical data (phosphate, nitrate, nitrite, and silicate) from four potential OTEC sites (Puerto Rico, the Gulf of Mexico, Hawaii, and the South Atlantic) show reasonable comparison with archival data. At this time sufficient data is available only at the Tampa site (Gulf of Mexico) to discern seasonal variations which show an influx of nutrient-rich water in February, which decreases with time to a minimum in December. Results show a greater potential for stimulation of primary productivity at the Hawaii site than in the northern Gulf of Mexico due to the discharge of the cold water pipe into the photic zone.

48329 (SERI/TP—34-180) **Alternate cycles applied to ocean thermal energy conversion.** Shelpuk, B.; Lewandowski, A. (Solar Energy Research Inst., Golden, CO (USA)). Feb 1979. Contract EG-77-C-01-4042. 14p. (CONF-790444—3). Dep. NTIS, PC A02/MF A01.

From Offshore technology conference; Houston, TX, USA (30 Apr 1979).

Four open cycle OTEC concepts are described. These are: (1) single, vertical-axis turbine; (2) multiple, horizontal-axis turbines; (3) foam lift/hydraulic turbine; and (4) mist lift/hydraulic turbine. A preliminary assessment of achievable performance is made in addition to a description of the subsystem performance objectives which would support the achievement of the full potential inherent in these concepts. The results and conclusions of the paper include a description of the research objectives, achievement of which make open cycle OTEC a viable alternative as a nationl energy source.

48330 **Iceberg utilization.** Husseiny, A.A. (ed.). Elmsford, NY; Pergamon Press, Inc. (1978). 773p. (CONF-7710197—).

From 1. international conference and work shops on iceberg utilization for fresh water production, weather modification and other applications; Ames, IA, USA (2 Oct 1977).

Fifty-four papers on iceberg utilization are presented covering: the state-of-the-art, tracking and selection, engineering and physical aspects, transport, protection, processing, regional considerations; international and national implications; weather modification; environmental and ecological aspects, alternate applications, and alternate systems. Abstracts were prepared for three papers with solar and ocean thermal applications. (MHR)

48331 **Energy and fresh water production from icebergs.** Heizer, R.T. (Kaiser Engineers, Inc., Oakland, CA). pp 657-673 of Iceberg utilization. Husseiny, A.A. (ed.). Elmsford, NY; Pergamon Press, Inc. (1978).

From 1. international conference and work shops on iceberg utilization for fresh water production, weather modification and other applications; Ames, IA, USA (2 Oct 1977).

Two developing technologies - ocean thermal energy conversion (OTEC) for electric power production, and iceberg utilization for fresh-water production - have potential for reducing the world's growing energy and water shortages. When combined, in the form of a dual-purpose ICETEC facility, they offer synergistic possibilities resulting in significant technical and cost benefits for each technology. The paper discusses the state-of-the-art of OTECs and iceberg systems, and considers a combined system which may produce more electric power than could be produced by the fuel consumed in towing an iceberg.

48332 **Icebergs as a heat sink for power generation.** Roberts, D.M. (Iowa State Univ., Ames). pp 674-688 of Iceberg utilization. Husseiny, A.A. (ed.). Elmsford, NY; Pergamon Press, Inc. (1978).

From 1. international conference and work shops on iceberg utilization for fresh water production, weather modification and other applications; Ames, IA, USA (2 Oct 1977).

A modification of systems designed to make use of ocean thermal graients for power generations is proposed as an adjunct to the use of icebrgs as sources of fresh water. In addition to energy production, the system provides more fresh water than corresponds to the mass of ice melted. Depending on design features, the plant can be used as a conventional SSPP (Solar Sea Power Plant) if or when icebergs are not available.

SOLAR RADIATION UTILIZATION

REFER ALSO TO CITATION(S) 48315

SPACE HEATING AND COOLING

REFER ALSO TO CITATION(S) 48292, 48293, 48446

48333 (BMFT-FBT—79-02) **Development and preparative measures for serial production of a modular solar domestic heating system.** Elchlepp, R.; Grallert, H.; Merges, V.; Ott, K.H. (Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (Germany, F.R.)). May 1979. 248p. (In German). Dep. NTIS (US Sales Only), PC A11/MF A01.

During the first development phase, detailed technical and economic system analyses have been made which were initial points for the necessary component development. These analyses comprised an estimation of weather influence, a conceptional study, investigations of all collector off-design parameters, control, characteristics of energy demand, system cost estimate and optimization, complete simulation of the solar thermal and conventional heating circle, and thermal and mechanical calcuations of each component.

48334 (BNL—26217) **Heat pump impact upon solar collector design and cost.** Andrews, J.W. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 5p. (CONF-790541—22). Dep. NTIS, PC A02/MF A01.

From International Solar Energy Society meeting; Atlanta, GA, USA (28 May 1979).

Required collector area in series solar assisted heat pump systems is determined for three cities as a function of collector performance characteristics and compared with systems in which the solar-derived heat is used directly. Effect on system performance of improvements in heat pump performance is discussed. A cost vs yield analysis of several existing collectors is performed.

48335 (DOE/NASA/CR—161228) **Solar heating system final design package.** (Contemporary Systems, Inc., Jaffrey, NH (USA)). May 1979. Contract EX-76-A-29-1037. 70p. Dep. NTIS, PC A04/MF A01.

Contemporary Systems has taken its Series V Solar Heating System and developed it to a degree acceptable by local codes and regulatory agencies. The system is composed of the Series V warm air collector, the LCU-110 logic control unit and the USU-A universal switching and transport unit. The collector was originally conceived and designed as an integrated roof/wall system and provides a dual function in the structure. The collector serves both as a solar energy conversion system and as a structural weather resistant skin. The collector can be fabricated in any length from 12 to 24 feet. This provides maximum flexibility in design and installation. The LCU-110 control unit provides totally automatic control over the operation of the system. It receives input data from sensor probes in collectors, storage and living space. The logic is designed so as to make maximum use of solar energy and minimize use of conventional energy. The USU-A transport and switching unit is a high-efficiency air-handling system equipped with gear motor valves that respond to outputs from the control system. The fan unit is designed for maximum durability and efficiency in operation, and has permanently lubricated ball bearings and excellent air-handling efficiency.

48336 (DOE/NASA/CR—161238) **Solar energy system installed at Mount Rushmore National Visitor Center in Keystone, South Dakota.** (South Dakota School of Mines and Technology, Rapid City (USA)). Jun 1979. Contract EX-76-A-29-1024; EX-76-C-01-2399. 42p. Dep. NTIS, PC A03/MF A01.

Information is provided on the system description, the design, and installation of the solar energy system installed at the Mount Rushmore Visitor Center. The system is designed to furnish about 45 percent of the heating for the total facility and about 53 percent partial cooling for the 2000 square-foot observatory. Such items as Acceptance Test Data, a complete set of as-build drawings, system performance data, problems, pictures, and other pertinent materials are included.

48337 (HCP/M4131—01) **Pre-printed papers of the second solar heating and cooling commercial demonstration program contractors' review.** (Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center). Nov 1978. Contract EC-78-C-01-4131. 758p. (CONF-781220—). Dep. NTIS, PC A99/MF A01.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

Separate abstracts were prepared for each of the 115 included papers. (MOW)

48338 (HCP/M4131—01, pp 9-14) **Solar retrofit Executive East Office Building, Stamford, Connecticut.** Wormser, E.M. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

Six rows of single glazed, selectively blackened, liquid flat plate collectors (a total of 138 collectors), augmented by hinged, anodized polished aluminum reflectors are used. The reflector-collector arrays occupy the available roof area. The polished hinged reflectors having a reflectivity in excess of 80% mounted at 10^0 to the horizontal increase solar energy collection by 46% in February at the height of the heating season.

48339 (HCP/M4131—01, pp 15-17) **Kaw Valley solar bank.** Abbott, D. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The collector array consists of 72 General Electric TC-100 evacuated tube collectors. A 50/50 solution of water and glycol is circulated through the collector to a heat exchanger where energy is transferred via a water loop to the storage tank. During mild weather when the storage tank reaches its high limit the collector fluid is circulated through a heat dump where city water is boiled off dissipating excess heat. Energy is taken from the storage tank and circulated via a water loop to the heating coils or absorption chillers on demand. Heat is dissipated from the chillers through a cooling tower. A small chilled water storage tank is used to stop short cycling of the chillers. Domestic hot water is heated from a double walled heat exchanger in the solar loop. Backup energy is provided by a gas fired boiler.

48340 (HCP/M4131—01, pp 19-23) **Kansas Unified School District 306: Mentor, Kansas, School Heating Solar Demonstration Project.** Hall, J.M. III. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The construction type is metal frame with brick fascia. The building has excellent insulation characteristics. The roof U-factor is 0.07. The wall U-factor is 0.05. The area of the building is 140,000 square feet and the student capacity of the building is 750 students. The building heating system consists of a closed loop water to air heat pump system with individual heat pumps in each classroom area, as well as roof-mounted heat pumps for the larger areas such as the gymnasium and the auditorium. The back-up heating system is all electric. The domestic water heating system consists of electric powered hot water generator type heaters which have the water supply to them preheated by the solar system. The solar supplemental system was designed to contribute approximately 50 percent of the building's space heating needs and 80 percent of the domestic hot water needs for the year. Early estimates of the power costs savings to the school district indicated approximately $10,000 to $11,000 per year.

48341 (HCP/M4131—01, pp 25-31) **Highlights Building solar energy program.** Reid, E.A. Jr.; Dechow, J.P. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

Columbia elected to design the solar system for the Highlights Bldg. with advanced concentrating collectors to maximize the quantity of useful solar energy collected from the limited area available for installation of the solar array on the building. The Honeywell half-parabolic tracking solar collector was selected for this application. The Honeywell collector is a declination tracking collector with a 40:1 concentration ratio. The collector system installed in the Highlights Bldg. includes 44 collector panels arranged in 11 rows with a total field area of 2978 sq. ft. Each collector row is approximately 68 ft. long, and is equipped with its own solar tracking system which tracks the sun within 2/10ths of a degree of arc.

48342 (HCP/M4131—01, pp 39-45) **Heating and cooling of a Florida office building.** Hancock, O.G. Jr. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Florida Solar Energy Center (FSEC) is retrofitting one of the Center's office buildings, approximately 5,000 square feet of space, with solar air conditioning and heating as a demonstration of the feasibility of these applications to the many visitors to the Center and the residents of East-Central Florida. The project will provide a unique opportunity to compare high-temperature non-imaging non-tracking evacuated-tube collectors with the imaging and tracking collectors used in the Disney World and the Florida Welcomce Station SHAC demonstration projects, since the three projects are similar in environmental conditions, size and configuration.

48343 (HCP/M4131—01, pp 47-50) **Solar space and water heating system for a Shoney's Big Boy Restaurant in North Little Rock, Arkansas.** McAlexander, W.G.; Perry, E.H. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

A solar energy system has been designed to supply 63% of the space heating needs and 56% of the domestic hot water requirements for a 5000 square foot Shoney's Big Boy restaurant to be built in North Little Rock, Arkansas. The solar heating system will employ 1428 square feet of flat plate hydronic collectors. The collectors shall employ double glazing and black-chrome on steel absorber plates. Because of the high demand for domestic hot water a very large fraction of the energy collected can be used.

48344 (HCP/M4131—01, pp 51-59) **Application of commercial integrated solar space heating, space cooling and domestic hot water for the Georgia Power Company's Atlantic Office Building.** Hensley, W.R.; Cruickshank, B.B. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The heating system utilizes 23,696 sq. ft. of parabolic trough collector to supply the 744,000 sq. ft. office building with space heating and cooling and hot water. The system design philosophy and reliability are discussed. (MOW)

48345 (HCP/M4131—01, pp 61-67) **Design, construction, and performance of a retrofit solar system for Madison Hall.** Gunther, K.E. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Solar System is designed to integrate with the existing Hot Water Heating and Domestic Water Heating System. The building involved is a 7,250 square foot, one story, slab on grade, frame construction with flat roof. The building provides dormitory space with fourteen (14) Student Rooms, House Parents' Apartment, Lounge and necessary toilets, showers, laundry and other support facilities. The building is insulated with 3 5/8" batts in side walls, 8" blown-in roof insulation and thermopane glazing Calculations indicate that 25% of the space heating load and 50% of the water heating load would be provided by the Solar System. Flat plate collectors were used. Some operational experience is described.

48346 (HCP/M4131—01, pp 69-73) **Padonia Elementary School solar and heating and cooling project.** Wilkening, H.A. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Padonia Elementary School is a one story masonary building of 45,000 square feet area built in 1965. It is typical of many Maryland schools. Heating is supplied by an oil fired boiler and cooling by compression refrigeration. The solar system installed is a rooftop concentrator design developed by AAI Corporation. This concept has undergone full-scale tests on the roof of our Solar Laboratory where it has provided energy for heating and cooling this 2,000 square foot building for the past two years. This concept uses the curved roof of a building as a substrate for a reflective surface, thus reducing the overall cost of the system.

48347 (HCP/M4131—01, pp 75-83) **Northview School, Howards Grove, Wisconsin.** Linde, R. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

A 2,277 sq. ft. solar air heater was used along with a 1,500 cu. ft. rock bin for thermal storage. A schematic drawing of the system is described. (MOW)

48348 (HCP/M4131—01, pp 85-92) **Solar assisted heat pump system for the Handzlik Clinic.** Zien, H.B. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

A solar-assisted water-to-air pump was used in an 8,000 sq. ft. offfice building located in West Bend, Wisconsin. Evacuated tube collectors were used along with a 4,000 gallon concrete storage tank. Operation of the system is described. (MOW)

48349 (HCP/M4131—01, pp 93-100) **Solar space heating system for West Chester Work Center.** Haron, A.S. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This is a solar space heating system for a newly-built one-story building having a 9,800 sq. ft. floor area. The T-shaped building consists of two basic sections. (1) The office section is heated and cooled by using water-to-air heat pumps units. The heat source for the heat pumps during the heating season only is solar-heated water, augmented by an electric boiler. (2) The warehouse section is heated by an air-handling unit using a solar-heated water-to-air coil. The air-handling unit is connected to ductwork and air diffusers. Solar energy is expected to provide 62% of the space heating needs.

48350 (HCP/M4131—01, pp 101-108) **Esslinger Medical Building, Traverse City, Michigan.** Moutsatson, G.P. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

A flat plate solar air heater with collector area of 663 sq. ft. is used for space heating and water heating. The 2,468 sq. ft. medical office building is located in the Northwestern Lower Peninsula of Michigan. A 342 cu. ft. pebble bed storage was used. (MOW)

48351 (HCP/M4131—01, pp 109-115) **Construction phase report: St. Charles High School solar system, St. Charles, Illinois.** Gordon, H.T. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The St. Charles School District, located in St. Charles, Illinois, was awarded a grant under Program Opportunity Notice DSE-76-2 to construct a solar-assisted heat pump in the 221,000 square foot St. Charles High School. The solar mechanical system for the St. Charles High School is designed to provide approximately 60 percent of the annual space heating and water heating demand by solar energy.

48352 (HCP/M4131—01, pp 117-121) **Cary Arboretum Solar Project update: design, submittal, construction, and operational problems.** Brown, D.F. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Cary Arboretum's Plant Science Building is a 27,400 sq. ft. education and research facility of the New York Botanical Garden, located east of the Hudson River, midway between New York City and Albany. Seven sawtoothed arrays on the roof hold 5,650 sq. ft. of liquid-cooled collectors. Some operational experience is described. (MOW)

48353 (HCP/M4131—01, pp 123-127) **Olive Grove: a total solar energy project.** Felburg, R.A. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This 110-store specialty shopping center consists of eight split-level buildings around a two-block-long sunken grouping of lakes and gardens with a waterwheel, waterfalls, rapids, and bridges. All buildings have 10-foot-wide balconies and roof overhangs with mansards covered by clay mission tile, and all roof wells are completely filled with 25,000 square feet of modified Winston type non-tracking concentrating parabolic collectors with an east-west longitudinal orientation facing four degrees west of south in azimuth and inclined at 30° in elevation.

48354 (HCP/M4131—01, pp 129-134) **Combined active and passive solar space heating and solar hot water systems for an elementary school in Boise, Idaho.** Smull, N.H.; Armstrong, G.L. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The proposed solar system is a space heating, domestic hot water system. The collectors are single glazed, with a selective surface, and are liquid-cooled. The space heating and domestic water systems are piped separately with approximately 370 square feet of collector area for the domestic hot water system and 1,830 square feet of collector for the space heating system. Both systems utilize an inhibited heat transfer fluid in the collector loop with shell-and-tube heat exchangers to storage.

48355 (HCP/M4131—01, pp 135-138) **Solar heated office building for the Burns/Peters Group, architects-planners.** Burns, W.L.; Bickle, L.W. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

A 6,000 sq. ft. office building is described. The building uses parabolic concentrating and tracking collectors for space and water heating. Some operational aspects of the system are described. (MOW)

48356 (HCP/M4131—01, pp 139-143) **Lincoln Housing Authority office building solar system, Lincoln, Nebraska.** Thomsen, C.L. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The building is a two-story masonry building. The lower floor is mostly below grade. The upper floor is used as office space for the Lincoln Housing Authority. The mechanical equipment room and a garage are located on the lower floor with the remainder of the lower floor space reserved for later development as future office space. The solar system is predicted to supply 50% of the annual space heating requirement and 90% of the annual hot water requirement. The flat plat collectors covered an area of 2,898 ft.^{2}.

48357 (HCP/M4131—01, pp 145-148) **Solar heating system for the Billings Shipping Corporation freight distribution facility.** Baker, J. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The solar heating system was designed with standard, off the shelf, components to provide a reliable system which can be maintained without technically trained personnel. The building construction was proceeding rapidly as the solar system grant was approved and only minor mofifications to the mechanical equipment were possible. With 44,000 ft^2 of flat roof upon which to mount collectors and an all-air heating and cooling system under construction, the flat plate, air to water solar collector was a natural choice. Air conditioning with solar heat was not considered because of the short air conditioning season. The domestic hot water consumption is too low to justify solar heating.

48358 (HCP/M4131—01, pp 149-154) **Solar heating and cooling demonstration project.** Brock, N. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The building is a "designed retrofit" on which 51 of the 151 Northrup Incorporated solar panels could be mounted. It is oriented north and south with a special roof design to recieve solar collectors. A portion of the roof faces south for this purpose and will tie into the other 100 collectors that are mounted on a large trellis which is on the same plane as the roof, i.e. 30° from the horizontal and in a 34° north latitude. The Trellis consists of seven 5"x18"x25' Glue Laminated Beams that are mounted on the retaining wall. The panels are supported on horizontal 6"x8" timbers that are bolted to the beams. The building is 12,000 square feet in size, a two-story modern chalet architecture, insulated with R-19 fiberglass in walls and roof. The exterior of the walls are sheeted with 3/8 inch plywood, 1/2 inch of gypboard an 3/4 inch of redwood shiplap. The windows are double pane with one pane being a solar bronze tint. The roofing material is an asbestos and cement composition called Cal Shake.

48359 (HCP/M4131—01, pp 155-161) **New Mexico Solar Energy Institute and College of Engineering hybrid solar building.** Lumsdaine, E. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The design of this new building to house the Civil Engineering Department, Engineering Technology, and the New Mexico Solar Energy Institute applies an air-cooled active solar system and passive solar design concepts together with other energy-conserving measures to obtain a building that is a good example of energy-efficient design and construction, yet is functional and aesthetically pleasing.

48360 (HCP/M4131—01, pp 175-178) **Two battalion headquarters and classroom facility solar project, Fort Hood, Texas.** Denys, A.D.; Armbrust, P.H. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This is a standard type 2 battalion headquarters and classroom training building used in many of the various modular troop barracks complexes either recently constructed or still under construction at some military facilities. The solar energy system, designed by General Electric using G.E. collectors, will provide approximately 90% of the total heating and cooling load. The standard sized mechanical room was expanded to provide space for the additional mechanical equipment and a visitor observation room.

48361 (HCP/M4131—01, pp 185-189) **Solar-assisted year 'round environmental control of a development and standards laboratory.** Pearson, R.; Pliemann, N. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

A 5,500 sq. ft. development and standards laboratory is to be heated by solar energy. Evacuated tube collectors were used along with cusp reflectors. The design philosophy is discussed. (MOW)

48362 (HCP/M4131—01, pp 201-203) **Stanford University Central Food Services Building solar space and domestic hot water heating system.** Beavers, C. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Central Food Services Building is located on the Stanford University campus, approximately 30 miles south of San Francisco. It is a single story complex with flat roofs. It is used for food preparation and storage and includes administrative offices. The building was previously fed by a stem main from Stanford's central steam plant. The building is at the end of a line about two miles from the plant. Over the years, significant deterioration occurred in this line resulting in wasteful heat losses. Stanford terminated steam service to the building and replaced it with a solar system and gas-fired backup. The combined solar space and water heating system is estimated to provide approximately 70 per cent of yearly load. The flat plate collector area is 840 sq. ft.

48363 (HCP/M4131—01, pp 205-207) **Solar space heating system: Seeley G. Mudd Education Building, Pacific School of Religion, Berkeley, California.** Bovill, C. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Seeley G. Mudd Education Building at the Pacific School of Religion in Berkeley, California was planned to have a solar space heating system retrofitted on to it. The architect, Charles Stickney, AIA, retained Interactive Resources, Inc., as solar consultants early in the design process. The active solar system will provide 36 per cent of the space heating needs. Good orientation, overhang protected south glass and massive construction will provide for additional passive solar heating. This building, with approximately 12,400 square feet of space, and with parking garage underneath, will be built at a cost of $1,500,000. Construction began in September 1978. The target date for completion is June 1979.

48364 (HCP/M4131—01, pp 209-213) **Proposed western energy office building.** Boyd, J.B. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The proposed office building design demonstrates a unique solution to a difficult building site; the triangular shape, setback requirements, poor soil conditions and parking requirements dictated placing the building on poles with parking underneath the building. Energy conservation and solar heating were part of the initial design criteria, with all ASHRAE 90-75 requirements being met or exceeded. Some design criteria are described.

48365 (HCP/M4131—01, pp 225-229) **Descanso Gardens Guild exhibition and educational arboretum and community complex.** Collins, D.L. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Descanso Gardens exhibition hall, classroom, and administrative complex is designed to provide a unique community educational facility for Los Angeles County. The buildings consist of a 4,400 square foot auditorium and exhibition hall, two 1,000 square foot classrooms, a 1,000 square foot administrative building, an 800 square foot gift shop, a food preparation and service area, and entry control point. The aesthetics of the buildings are designed to match the woodsy arboretum atmosphere and are unsuitable for direct installation of solar collectors. The system design separates the solar collectors into a ground mount installation which conceals the collector from the visitor's eye until brought to his attention. The entire system is designed to aesthetically blend with the complex pristine, sylvan surroundings. The passive portion of the system provides 25% of the cooling load and 40% of the heating load for the buildings. The active solar system provides the balance of the load requirement up to an aggregate total of 87%.

48366 (HCP/M4131—01, pp 231-238) **Integrated solar heating, cooling, and hot water system for the San Diego City Schools' University City High School, San Diego, California.** Fergin, R.K.; Canner, R.E. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

University City High School is one of the currently funded school projects of the San Diego Unified School District (SDUSD). These projects and other recently completed and contracted projects are based on life-cycle cost analyses. They employ state-of-the-art mechanical and electrical designs and prototype designs for gathering operating and energy data for future school projects. Heating, cooling, and domestic hot water heating by solar energy will be utilized in this new high school project.

48367 (HCP/M4131—01, pp 239-246) **El Camino Real School solar project: Irvine Unified School District, Irvine, California.** King, D.E.; Smith, K.E. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This project was awarded by ERDA in response to a proposal submitted by the Irvine Unified School District, Irvine, California, under PON 1. It has resulted in the installation of a retrofit alternative energy source for an existing gas fueled absorption heating and cooling system on the 41,000 square foot El Camino Real Elementary School in Irvine. Evacuated tube collectors were used.

48368 (HCP/M4131—01, pp 247-253) **Lake Valley Firehouse solar project.** Lucas, J. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

Lake Valley Firehouse No. 2 is located at South Lake Tahoe, California. It is a small facility requiring the heating needs of about a 4,700 square foot residence. The elevation is approximately 6,300 feet. Average daytime summer temperatures are approximately seventy-five degrees and average daytime winter temperatures are approximately thiry-five degrees. Flat plate collectors were used in the demonstration program.

48369 (HCP/M4131—01, pp 255-260) **Santa Clara Community Recreation Center solar heating and cooling project.** Saunders, R.G.; Davis, J.N. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Santa Clara, California, Community Center is a 27,000 square foot building which is used to provide educational and recreational programs for area residents. The solar system utilized 7,085 square feet of double glazed, selectively coated, copper absorber solar collectors manufactured by Ametek, Inc. Cooling is provided by two 25 ton Arkla lithium bromide absorption chillers. Storage consists of a 10,000 gallon hot water tank and a 50,000 gallon cold water tank. Computer simulations performed by Lockheed Palo Alto Research Laboratory indicated that the system would provide 84 percent of the Center's heating requirements and 65 percent of the cooling needs. A complete, fresh air economizer cycle is incorporated into the cooling system design.

48370 (HCP/M4131—01, pp 261-265) **Solar heating system for a fire station in Long Beach.** Sosoka, J.R. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The solar system consisted of 277 sq. ft. of single-pane, flat-plate, liquid-cooled collectors. The fire station consists of approxi-

mately 4,200 sq. ft. of office and living space and a 2,500 sq. ft. apparatus room. (MOW)

48371 (HCP/M4131—01, pp 267-268) **Celestial Seasonings solar heated office and processing building in Boulder.** Bushnell, R.H. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

Celestial Seasonings, Inc., a producer of herb teas, is planning a new processing and warehouse building along with an office building to be built in Boulder, Colorado in 1979. The processing and warehouse building will be 60 m north—south and 134 m east—west. The office building which will be attached to the south of the processing building will be 31 m north—south and 49 m east—west. Both will be two stories high. Flat plate collectors will be used.

48372 (HCP/M4131—01, pp 269-273) **Telluride School: a passive hybrid retrofit.** Erdman, T.; Doud, E.; Hobbs, K.; Slack, P. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Telluride School was built in 1966. The building is in generally sound condition but has three major problems in energy efficiency: 1) a number of poorly sealed doors and windows, 2) a small amount of insulation, and 3) an increasingly expensive primary heating fuel (oil). The retrofit design chosen is a glazed building enveloped on the northeast and southwest sides of the classroom wing, insulating those walls while collecting and storing solar heat. A separate Trombe wall will be constructed on the southwest gym wall. Storage will be in the existing 10" masonry walls as well as active rock storage on the northeast and southwest sides of the classroom wing. The system is predicted to provide about 40% of the school's space heating load.

48373 (HCP/M4131—01, pp 275-281) **Grand Junction, Colorado, DOE solar demonstration project.** Price, T.D. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Grand Junction Solar Demonstration Project was an add-on to the new 3,000 sq. ft., 120-seat cafeteria that was built in 1977. This building is a slab on grade frame structure designed for energy conservation with R-19 walls, an R-30 ceiling, and minimum glass area. Evaporative cooling was chosen for summer since the Grand Junction Office is located in a dry desert environment. The solar collector was sized using the method given in the DOE Facilities Solar Design Handbook. This method gave an optimum collector size of 500 sq. ft. to supply an estimate 40 percent of the building's hot water and heat.

48374 (HCP/M4131—01, pp 283-286) **Use of solar energy and energy conservation measures in a state-supported housing project for the elderly in Connecticut.** Eveleth, D.D. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

Non-selective flat-plate copper collectors were used. The building desigr specifics along with some problems and their solutions are discussed. (MOW)

48375 (HCP/M4131—01, pp 287-290) **Danbury Hospital solar energy project.** Kuszpa, F.J. Jr. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Danbury Hospital began a two-step building program in 1968. The first step consisted of a masonry four-story base building housing diagnostic and treatment facilities. That would be topped, as a second step, with an eight story steel panel tower used predominately for patient bed space. The tower added an additional 184,000 square feet of space to bring the entire structure to a total of 331,544 square feet. The solar system consisting of 18,669 square feet of flat plate collectors will preheat the domestic and laundry hot water, and supplement the reheat system portion of our space heat. The tower consumes 20,767 gallons of hot water daily resulting in an energy use of 16.9 million Btus per day, 4,617 million Btus per year. Space heating requirements total 29,900 million Btus per day or 13,870 million Btus per year. The solar energy system will ideally carry 34% of the hot water load and 21% of the reheat load.

48376 (HCP/M4131—01, pp 291-298) **McColl-Wade, Inc. solar office building.** McColl, J.R. Jr.; Beringer, R.E. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The McColl-Wade building solar project is an air space heating and hot water system. The building site borders 182 feet along the northerly side of U.S. Route 1 (250 West Main Street, Branford, Connecticut). It is comprised of approximately 7,000 square feet of offices, warehouse, sheet metal shop, and entry module. The thoroughly insulated frame structure was designed with a large sloping side at a 53° angle and holds 100 solar panels. The building faces south 177° True, for the main purpose of producing surface area for solar collectors.

48377 (HCP/M4131—01, pp 299-301) **Albie Booth Memorial Boys' Club, New Haven, Connecticut.** Sullo, R. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Albie Booth Memorial Boys' Club was built in 1971 to serve as a boys' club and community center. The building is approximately 35,000 square feet and is one story of masonry construction with a combination steel roof deck and precast concrete beams roof construction. It was determined to use liquid filled collectors roof mounted. The only area that was available for mounting was on the roof. The site had no available space. Since there was existing hot water distribution piping available for integration of liquid collectors plus the difficulty of storage and ductwork with air collectors in this building, liquid collectors were selected.

48378 (HCP/M4131—01, pp 303-304) **Village Street Office Building, North Haven, Connecticut.** Sullo, R. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The building was an existing elementary school and is approximately 70 years old. It is a two story masonry and wood frame construction and contains 23,500 square feet of floor area. The building is presently being converted into office spaces. The solar system is designed to provide approximately 75% of the building load. It will be used for for space heating and hot water for the months of October through April. It will be used for space heating plus 100% of the hot water load in May and September, since there is sufficient collected solar energy to supply 100 percent space heating with an excess to provide all of the hot water in these months. In the summer months of June, July, and August the system will be used to supply all of the hot water demands. The solar heating system will comprise 100 liquid filled, flat plate, roof mounted collectors with a total effective collector area of 2,100 sq. ft.

48379 (HCP/M4131—01, pp 313-321) **Installed solar air conditioning, heating, hot water, and pool heating system for the LIFE Clinic.** Hudson, W.T. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

A 25 ton solar air conditioning system has been installed and made operational for a sports-medical center in Brandon, Florida. The system is expected to provide 80% of the building energy needs in air conditioning, space heat, and domestic hot water. The retrofit installation was completed, including acceptance test, in two (2) months from the date the equipment was delivered to the site. One week site preparation work was required to adapt the facility for the solar system. This time was nominal since the building had been constructed with the intent of installing a solar system at a later date. Condensor water heat from the chiller as well as collector heat is used to heat the 600,000 gallon swimming pool during the cold weather. The combined energy uses offer a potential payback of twelve (12) years.

48380 (HCP/M4131—01, pp 323-330) **Florida Welcome Station solar heating and cooling project.** Sechler, T.A. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Welcome Station is a single story concrete block stuccoed building of Spanish design. It has a concrete roof deck and a built-up type roof. Glass was kept to a minimum except for two sets of automatic opening double glass doors for visitor entrance and exit. About 15% of the area is for mechanical equipment and fifty percent is for storage and office space. The remaining 35% of floor area is for visitors, a refreshment counter and literature racks. A concentrating Fresnel lens solar system is expected to produce sufficient chilled water to satisfy about 88% of the annual Welcome Station cooling

load. Hot water generated from the system will meet 100% of the annual heating load at expected outdoor design conditions.

48381 (HCP/M4131—01, pp 331-337) **Solar office building, Reedy Creek Utilities Co., Inc., Walt Disney World.** Smith, W.K. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

In November 1977, the utility company servicing Walt Disney World put into operation a new two-story office building, specifically designed for a unique solar energy system. Solar energy powers air conditioning, space heating and potable hot water supply. The solar collectors are the roof of the building. They are horizontal parabolic mirrored troughs which focus on tracking absorbers, moving in one dimension, and water cooled. The chiller is a commercially available 25-ton lithium bromide adsorption unit and utilizes an existing cooling tower system as the heat sink. The building has 5,625 square feet of air conditioned space and the collector area of the roof is 3,840 square feet.

48382 (HCP/M4131—01, pp 339-347) **North Georgia Area Planning and Development Commission headquarters building: solar cooling, heating, and hot water demonstration project.** Sutherland, G.; Kolberg, D.W. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The solar design submitted to ERDA for the new building was for a heating, cooling, and domestic hot water hydronic system which would utilize 100 flat plate, double glazed collectors (1,740 square feet) augmented with a reflector array. Solar cooling would employ an Arkla Solarie 300 absorption chiller and supplementary (back-up) heating would be provided by an oil fired boiler. Storage for thermal and chilled water was to be provided by three 5,000 gallon tanks. The system was designed to provide 60% of the cooling, 90% of the heating and a small supply of domestic hot water.

48383 (HCP/M4131—01, pp 349-357) **Shenandoah Solar Recreational Center.** Williams, J.R.; Craig, J.I. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Shenandoah Solar Recreational Center, when completed early in 1977, was the world's largest building to have most of its heating, air conditioning, and domestic hot water needs met by solar energy. The building incorporates 11,213 ft^2 of double glazed black chrome selectively coated copper tube-in-strip flat plate solar collectors oriented at an angle of 45^0 to the South with 23,000 ft^2 of highly polished aluminum reflectors to provide energy for heating and air conditioning the 59,000 ft^2 community center. Each of the 63 solar collectors are 8.61 ft. high and 20.7 ft. wide with the copper tube-in-strip absorber plates insulated on the back side to a K value of 0.05 $Btu/ft^2/^0F/hr$. Thermal storage is provided by a 15,000 gal. hot water storage tank, a 2,200 gal. buffer tank, and two 30,000 gal. chilled water storage tanks. The large tanks are buried beneath the earth berm surrounding the sides of the building. The system was designed to supply 64% of the cooling, 95% of the heating, most of the domestic hot water and pool heating.

48384 (HCP/M4131—01, pp 363-365) **Solar energy system for space heating and space cooling.** McNamara, T.J. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The retrofit solar energy system is integrated into the existing air handling systems serving approximately 70,000 square feet of occupied space (10% of total space). The solar energy system is designed to provide 29% space heating and 44% space cooling of the total annual requirements.

48385 (HCP/M4131—01, pp 367-371) **Solar Suites: a medical office building solar system review.** Chiplis, T.J. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

Solar Suites is a medical office building. The structure is composed of a first and second floor with four medical suites per floor plus a partial basement. The two floors total approximately 18,000 square feet, with another 3,400 square feet in the basement. The building is shaped in a long rectangle with the short side and all solar collectors oriented due south. Window area comprises 15% of the exterior wall area. There are no openings on the north face. The south face of the structure is sloped to grade and is covered with solar collectors. Windows have been integrated into this collector array to let in natural light and to provide an outside view for occupants in the adjacent office areas. The flat plate solar system was designed to provide 50% of the building space heating needs and 79% of the domestic hot water heating needs.

48386 (HCP/M4131—01, pp 373-379) **Solar energy retrofit for Clarksville Middle School, Clarksville, Indiana.** Galbreath, J.W.; Spaulding, M.F. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The solar heating system is to provide heating for the two gymnasiums in the middle school building. The present level of energy consumption to heat these spaces compared to the rest of the school building is considerable. Compared to classrooms with their greater student density and lighting levels, the gymnasiums are consuming heat energy all through the heating season. Flat plate, single glazed, selective coated solar collectors are installed on the roof of each gymnasium with the panel array facing due south. The collectors are tilted at 50^0. A storage tank facility is being installed below grade adjacent to the school building. A piping system will circulate water from the storage tank through the collectors and return the heated water to the storage tank.

48387 (HCP/M4131—01, pp 381-388) **Performance of the Scattergood School solar heating system during the 1977—1978 heating season.** Heins, C. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The heating system is a hot air system that heats the school's new 6,900 sq. ft. gymnasium and preheats water for use in the adjoining locker rooms. A collector array of 128 Solaron 2001 flat-plate collector panels is attached at an angle of 50^0 to the south wall of the gymnasium. The collector area is 2,496 sq. ft. An insulated, reinforced-concrete box 8 ft. by 25 ft., located under the collector and containing about 65 tons of washed river gravel, provides heat storage. Above the rock storage box is a 5,000 cfm air handling unit. Air is distributed to the gymnasium through overhead ductwork and a series of double deflection registers. Back-up and supplementary heat is furnished by two 250,000 Btu/hr propane heaters mounted in opposite corners of the building.

48388 (HCP/M4131—01, pp 389-395) **Longfellow School, Marion, Iowa.** Hynes, J.M. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The initial design included a 5,000 sq. ft. collector field, 8,000 gal. buried tank, collector system with anti-freeze solution, collector to boiler heat exchanger, air-cooled fluid cooler for purging. Final design resulted in 4,896 sq. ft. of collector, ASME 8,000 gal. tank above ground, purge convertor using City water instead of the fluid cooler, and a summer drain-down system.

48389 (HCP/M4131—01, pp 397-398) **Johnson County Jail, Iowa City, Iowa.** Schoenfelder, J.L. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

An jail being a 24 hour confinement facility requires by code a fairly high fresh air requirement. It also has a high domestic hot water load. The collector system was designed to preheat ventilation air and provide domestic water pre-heating when excess heat is available. A small flat plate collector array was chosen to match the ventilation load and to provide hot water with a minimum amount of storage (3,500 gallon). The collector array was also designed to double as a heat recovery system at night to transfer heat from exhaust air to the fresh air; consequently, an air type system was thought to be the most practical.

48390 (HCP/M4131—01, pp 399-404) **Comparison of a liquid an an air solar heating system applied to the same structure as applied at Rademaker Corporation, Louisville, Kentucky.** Rademaker, R.W. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

Occupant of building is Rademaker Corporation, Bluegrass Industrial Park, Louisville, Kentucky. It is a Butler building with a total area of 10,000 square feet of ground cover. The front wall of the office is brick veneer with relatively large glass area. The solar

heating system described herein is for space heating and for heating domestic hot water. Two systems are employed, one is a liquid heating system employing ethylene glycol through six collectors of 40 square feet each inclined at 53°, facing south. The second system is an air collector system employing 10 panels of 19-1/2 square feet each inclined at 33°, facing south. The liquid system uses a 560 gallon water tank for storage. The air system uses 110 cubic ft. of 1" diameter washed river gravel for storage.

48391 (HCP/M4131—01, pp 405-410) **Solar heating for field house, Louisiana State University, Baton Rouge, Louisiana.** Evans, W.J. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

Some of the characteristics of the building construction are listed. Flat plate liquid-cooled collectors were used for space heating and domestic hot water heating. The collector area was 5,560 sq. ft. Some design criteria are described. (MOW)

48392 (HCP/M4131—01, pp 411-413) **Northeast Carry passive solar retrofit.** Poitras, R. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Northeast Carry building is a standard 100 year old brick building located on the banks of the Kennebec River in historic Hallowell, Maine. The building houses offices and a small store in 800 sq. ft. of floor space. Although the initial proposal for retrofitting the Northeast Carry building consisted of a simple double glazed kalwall covering for the structure's exposed 800 sq. ft. southwest wall, the lack of clear, precise boundaries between properties, and resistance from adjacent property owners and Hallowell's historic community necessitated the shift in the proposal as outlined herein. The redesigned collector will enclose approximately 200 sq. ft. of the southeast face of the building which is not readily visible from the street and is directly adjacent to the property leased by Northeast Carry. The proposed collector will provide an estimated 30% of the building's heating requirements.

48393 (HCP/M4131—01, pp 423-426) **Town of Concord, Massachusetts solar space heating project at the Municipal Light Plant Building.** Hartwell, D.W.; Minty, J.G. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Town's solar project is an air space heating system. It has been retrofitted to our Municipal Light Plant Building, a one-story masonry block structure with a flat roof and concrete floor. The building is used for both office and warehouse functions. Orientation is slightly west of due south in an open area. The solar system is being used to heat 2,700 square feet of office space and 5,700 square feet of warehouse area. It is estimated that the 1,932 gross square feet of collectors will supply approximately 70% of the annual heating load. Backup heat is supplied by existing unit heaters.

48394 (HCP/M4131—01, pp 424-429) **Fern Engineering Co., Inc., solar space heating system, Bourne, MA.** Levine, P. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The building is approximately 60 feet wide and 100 feet long, of steel construction with an aluminized steel roof with a 5 degree pitch. Use of the Solafern collectors accommodates their arrangement into two long rows, each 89 feet long and only 4'-8" high. The collectors are strategically located so the reflector span in front of each collector is approximately 15 ft., thereby resulting in a high reflector effectiveness.

48395 (HCP/M4131—01, pp 431-435) **Solar heating experiment on the Grover Cleveland School, Charles Street, Boston, Massachusetts.** Mulkern, J.J. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Grover Cleveland School was constructed in 1925. In 1972, an addition was put on and the original building renovated. The new addition to the building is a 61,000 square foot, three story high brick masonry structure. The addition consists mostly of a gymnasium, metal shop, woodworking shop, printing shop and classrooms. This addition was built to accommodate 1,400 pupils and teachers and the renovated original building accommodates 800 persons. Forty-six hundred square feet of flat plate water-cooled collectors were used.

48396 (HCP/M4131—01, pp 437-441) **Integrated solar space heating for the Walter R. Bemis Elementary School.** Andringa, G. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Bemis Elementary School is one of three identical buildings being built within the school district. Designed to accomodate 600 students, the single story building contains twenty classrooms, a large media center, gym, cafetorium, public branch library and related support spaces within 61,000 square feet. Foam-in-place insulation (4") within the exterior masonry cavity walls, double glazed window areas and 3-7/16" thick fiberglass/urethane roof insulation provide a "thermos bottle" environment which will not require heat from an auxiliary source during occupancy unless outdoor temperatures fall below 8°F. The solar system provides forty percent of the total heating load. Five thousand square feet of flat plate collectors uere used.

48397 (HCP/M4131—01, pp 443-448) **Plymouth City Hall, Plymouth, Minnesota.** Bansal, J.M. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

Plymouth City Hall contains 31,492 square feet on two floors. The structure is a concrete pan and joist system, with the exterior primarily of brick. The first floor contains the Council Chambers and general offices, and the ground floor houses the Police Department, mechanical equipment and future expansion space. The building has a northwest—southeast orientation, with the northwest corner set into a hillside and a two story curved wall facing essentially south. The northeast and northwest walls contain few penetrations while the south-facing curved wall has insulated, recessed, fenestration for the general office areas. It is estimated that the flat-plate solar system will satisfy 23.7% of building heating and 51.5% of domestic water heating requirements. On an overall basis, 24.4% of total heat energy requirements will be satisfied by the proposed solar system.

48398 (HCP/M4131—01, pp 449-455) **Solar heating and cooling for an underground building at the University of Minnesota.** Bligh, T.P.; Ramsey, J.W. (Univ. of Minnesota, Minneapolis). Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This program is for the design and construction of a demonstration solar heating and cooling project at the University of Minnesota. A new building, Williamson Hall, was commissioned in April, 1977, and has 7,700 m^2 (83,000 ft^2) of floor area, 95% of which is below ground level. A 613 m^2 (6,600 ft^2) SLATS concentrator solar system is currently being installed. The installation, which will be completed by January 1979, will supply an estimated 50% of the annual heating and cooling energy requirements for the building.

48399 (HCP/M4131—01, pp 457-463) **Paulucci Planetarium, Hibbing Community College, Hibbing, Minnesota.** Sandberg, R.Y. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The building is angular in plan with a 37° chisel shaped roof section affording the sun directed surface for the collectors. There are 4,850 square feet ground coverage and 3,000 square feet of roof area. The building esthetics are compatible with the design of the rest of the campus. Reinforced concrete forms the below-ground structure up through large surrounding berms. In the basement area is a 225,000 gallon heat sink and work area. The main floor contains the hyposhere area, lobby, and ancillary functions. Above grade, metal skin on structural steel envelopes the area with the roofs the same metal as sidewalls. Fenestration in the building is limited to entrance doors reflecting the planetarium function. A triple vestibule minimizes air infiltration. Long steel wide flange sections run down the slanted roof surface to carry the collector field.

48400 (HCP/M4131—01, pp 465-470) **Minnesota Zoological Garden solar energy exhibit.** Young, W.A.; Peterson, R.L. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

For the most cost effective utilization of solar energy this demonstration project provides a solar heating system which has been sized to provide space heating and domestic hot water requirements. The initial system utilizes 460 hydronic flat plate collectors

totalling 8,280 square feet. The solar system is designed to provide 25% of the present connected heating needs and 24.8% of the domestic hot water needs. Although this system is capable of providing space heating requirements for five animal holding buildings adjacent to the solar facilities, for budgetary reasons this was not included with the first phase development. However, portions of the underground distribution to those buildings are provided under the hard-surfaced areas of the complex walkway system. This will be used for future expansion of the system.

48401 (HCP/M4131—01, pp 471-474) **Security State Bank, Starkville, Mississippi.** Alperin, A.M. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This building is to be a drive-in branch of the main office to be located on a corner lot fronting Highway 12, near the Mississippi State University main campus. It is designed as a modern structure with the roof supporting the solar collectors facing approximately 4° southeast from due south. The structure is on a concrete slab with heated space of 788 square feet. Perimeter walls are of dryyit siding, 1/2" gypsum board sheathing, 4" fiberglass insulation, and 5/8" gypsum board. The roof is metal with 5/8" wood deck, 9" batt insulation and 5/8" gypsum board. Glass is 5/8" double bronze. Solar air heaters with 96.2 cubic feet of rock bed storage were used.

48402 (HCP/M4131—01, pp 475-478) **Clarksdale Solar Bank.** Alperin, A.M. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This new building is to be a full service branch of the Clarksdale bank located on a corner site facing State Highway No. 3 in the industrial area of the town. It is designed as a modern contemporary structure with the roof supporting the solar collectors facing 15 1/2 degrees west of south from due south. The structure is on a concrete slab with heated space of approximately 2,150 square feet. Perimeter walls are wood siding, 3/4 inch insulating sheathing, 4 1/2 inches standard space with R-19 batt insulation, 5/8 gypsum board on 2x6 strips. The truss roof is covered with a metal deck on 5/8 inch plywood, with R-38 batt insulation between the trusses. An acoustical ceiling is suspended below except in the vaulted area which has a 5/8 inch gypsum board ceiling. All glass is insulating type. Solar air heaters utilize 285 cubic ft. of rock storage.

48403 (HCP/M4131—01, pp 479-482) **Kansas City Capital of the age of enlightenment.** Chelnov, M. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The building is a two-wing story motel type building. The residential wings are double loaded corridors. Meeting and dining spaces are located centrally and at the ends. The length is 266 feet, the width 45 feet, with a total area of 24,000 sq. ft. The solar air system heats the residential wings which have a square footage of 15,000 sq. ft. Some 78% of their seasonal heating load will be met by the solar heating system. This will be 52% of the total building heating load.

48404 (HCP/M4131—01, pp 483-488) **Solar heating system, Stephens College Visitors Center.** Henley, M. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This 15,000 square foot building, measuring 40 feet by 90 feet, with four floors, is centrally located on a college campus and is to function as a visitors center. The main floor houses the Admissions Office, which is generally the first stop for campus visitors. Below this floor is the mechanical equipment area and a 40 foot x 40 foot room, with a separate outside entry, that will be the Faculty Club. The Visitors Center was designed especially for a solar energy application, and as such, special care was taken to reduce the heating and cooling loads. Similarly, the solar system was designed to be as efficient as possible. The building construction is about 90% complete at this writing, and it is expected that the solar system will provide about 50% of the heating requirements. The projected completion date for the building is December, 1978. Flat-plate liquid-cooled collectors were used.

48405 (HCP/M4131—01, pp 489-491) **Solar heating demonstration project description, Young Men's Christian Association of Hastings, Nebraska.** Innes, V.A. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Hastings YMCA building is a completely new facility containing an indoor swimming pool, a gymnasium, four handball courts, excercise and meeting rooms, and office and locker facilities. The building contains approximately 48,000 sq. ft. of enclosed area. Flat-plate liquid-cooled collectors were used.

48406 (HCP/M4131—01, pp 493-498) **Solar space heating and domestic hot water for the Cherry Hill Inn, Cherry Hill, New Jersey.** Colm, H. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Inn is a combination Country Inn, Hotel and Convention Center with indoor and outdoor swimming pools, accommodations for 600 guests and meeting facilities for 4,000 people. A collector area of 5,733 ft^2 was chosen for the G.E. TC-100 evacuated tube collectors. A 7,500 gallon stainless steel tank was used. (MOW)

48407 (HCP/M4131—01, pp 499-515) **Passive solar space heating and active domestic hot water for the Princeton Education Center at Blairstown.** Fraker, H. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Princeton Education Center at Blairstown (PECB) received its PON Grant to assist in the construction of Passive Solar Heating Systems and an Active Domestic Hot Water System. The Passive Heating and DHW Systems are an important part of the first phase of construction of a Total Development Plan for the PECB. The Passive Solar Heating and Active DHW systems represent a significant shift in the solar applications philosophy of the original Total Development Plan, which was conceived with an active liquid collector system and a large central storage facility. This shift corresponds to a learning curve on the part of the project Architect regarding the advantages and comparative cost effectiveness of Passive Systems for space heating. The future development plans of the PECB will integrate solar collection/storage/ and distribution into the enclosure of the building itself and utilize active collectors for DHW only where appropriate.

48408 (HCP/M4131—01, pp 517-520) **Somerset County Environmental Education Center Building: solar energy system operational experiences.** Jones, W.A. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Somerset County Park Commission (S.C.P.C.) began planning for the ingegration of a solar energy system into its proposed Environmental Education Center (EEC) in 1971. The building site is in the Great Swamp Basin near the town of Basking Ridge, New Jersey. The solar system was completed and put into operation on October 15, 1976, and the new 18,000 ft^2 EEC building opened to the public on January 3, 1977. The solar system is a closed liquid, active type and is the primary source of energy used to heat, cool, and supply domestic hot water to the building. It utilizes 135 G.E. aluminum flat plate single glazed collectors mounted inside the building just under a Lexan® clear plastic glazed greenhouse-type roof. Total absorber plate area is 3,105 ft^2 at a cost of $15.00 per ft^2.

48409 (HCP/M4131—01, pp 521-527) **Contractor's review for a new 40,000 sq. ft. hydronically operated, solar heated and air-conditioned control valve manufacturing facility located in southern New Jersey.** Little, R.K. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This Cost Share contract with ERDA involves the solar heating and air-conditioning for a new building of conventional cement block, steel post, bar joist, metal deck construction. The building contains 40,000 square feet and is 200 feet on a side. Office space occupies approximately 16% of the building area. Manufacturing space occupies 84%. Both areas are to be heated and air-conditioned by solar energy. The solar system is a liquid type system and consists of 3 basic loops: a closed pressurized loop between a heat exchanger in the mechanical room (within the building) and the solar arrays, an atmospheric pressure loop between the heat exchanger and the storage tanks, and a distribution loop between the storage tanks and the air handling units in the manufacturing and office areas.

48410 (HCP/M4131—01, pp 537-542) **Animal Control Center addition.** Dexter, M.E.; Mueller, W.A. Nov 1978.
From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The major requirements of the addition to the Albuquerque Animal Control Center were that it must provide 2,200 sq ft office space and 4,300 sq ft kennel and service area. The building must be of masonry construction to accommodate frequent washdown and occasional steam cleaning. It must sit on a rectangular lot with long axis east—west. Energy conservation and solar energy design features were to be incorporated. Only those features with a payback period of 25 years or less would be included in construction. Within these constraints all reasonable options were to be studied. Both active and passive systems were used. Concentrating collectors that tracked the sun were used along with a 1,500 gallon water storage tank.

48411 (HCP/M4131—01, pp 543-550) **New Mexico Department of Agriculture solar heated and cooled building.** Fenton, D.; LaPlante, D.; San Martin, R.L. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The New Mexico Department of Agriculture (NMDA) building became operational during the early fall of 1975. Subsequently, an instrumentation system was designed and installed on the NMDA building to determine the performance of the solar system. The collected data shows that the heat load fraction provided by the solar system approaches unity. Cooling system performance was evaluated for the month of August 1977. The solar contribution to the cooling load was calculated as 30 percent including parasitic electrical energy. The economic analysis indicated that due to unique circumstances, the net added cost of the solar system was $29,600 resulting in a payback period approximately equal to 4 years.

48412 (HCP/M4131—01, pp 551-558) **Ballston Spa Central School District solar heating and hot water demonstration project.** May, B.E. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

Ballston Spa Central School District is a medium sized public school district located in Central New York State about twenty miles north of the state capitol at Albany. As a means of meeting this objective the school district chose its primary middle school, a set of two single story buildings under one roof, although mechanically separate, to use as a model for the project. The total building area consists of 136,000 square feet and it is typical in construction technique to most of the public buildings constructed during the sixties and later. It is an all electric facility which makes it similar to over two hundred other New York State public school buildings. Flat plate collectors were used.

48413 (HCP/M4131—01, pp 559-565) **Grayview Building solar energy installation.** Meyer, J. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The proposed site for the installation of a retrofit, closed loop, solar space heating and domestic hot water system is the Grayview Building, located at 2 Lakeview Avenue, Lynbrook, New York. The Grayview Building is a one-story, 5,000 square foot office building with heated facilities in the basement area. The specific solar system proposed for the site (Daystar = MOD 10 XHRB) was chosen for several reasons; among them were compatability with the existing heating system, collector tests results, performance data, cost per million Btu's delivered comparisons, reliability of the manufacturer, etc. The final decision was quite difficult due to the large number of high quality solar systems currently offered on the market.

48414 (HCP/M4131—01, pp 567-573) **Description of a retrofit solar heating, cooling, and hot water system for an urban mixed use building.** Wertz, S.; Grunig, J. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The solar energy system will be installed in an existing five-story and cellar commercial and residential building located in the mid-West side of Manhattan. It houses moderate income families in seven apartments in the upper stories and accommodates local businesses in the lower one and one-half stories and cellar, including a restaurant, small bakery, two small stores and an office. The building covers almost the entire site on a south- and west-facing corner lot, and is about 25 feet by 85 feet high above the curb, 2,190 square feet per floor, containing a total of about 13,140 gross square feet. The solar energy system is sized to partly meet the heating and hot water demands and to meet almost all of the cooling demand. The active hydronic system consists of five individual subsystems which generally interface at heat exchangers: collector subsystem, storage subsystem (through back-up boiler), cooling subsystem (absorption unit fired by heating circuit) and domestic hot water subsystem.

48415 (HCP/M4131—01, pp 575-578) **Solar for Area Health and Education Center.** Abernethy, L. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The solar system installed was a retrofit to the 6-story Area Health and Education Facility which was under construction at the time of the grant application. The retrofit consisted of adding a hydronic space and domestic hot water heating system with underground storage to the above system. The collector array consists of 171 General Electric Type FP collectors with single LEXAN(R) cover at a cost of $49,590.00 for the 3,950 square feet.

48416 (HCP/M4131—01, pp 579-586) **Basin Electric headquarters building solar heating demonstration, Bismarck, North Dakota.** Dunham, G.F. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Basin Electric Power Cooperative headquarters building is a 4-story, approximately 75,000 sq. ft. office building. The building is located in Bismarck, North Dakota and was designed in 1974 and occupied in January 1976. An analysis of the building energy requirements in conjunction with Bismarck weather data and solar insulation indicated that 5,000 sq. ft. of flat plate collector was the minimum collector area which would provide a meaningful demonstration. The flat plate collector was selected rather than a concentrating collector because the building system could utilize relatively low temperature water effectively and because of cost. The analysis showed that the installation is expected to provide $1{,}945 \times 10^6$ Btu of usable energy for the building per heating season. That energy is equivalent to 34% of the building heating energy.

48417 (HCP/M4131—01, pp 587-588) **Jamestown College solar heating and domestic hot water system Lifetime Sports Facility.** Steller, R.M. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Solar Energy System at Jamestown College will be installed adjacent to the new Lifetime Sports Facility located on the campus of Jamestown College in Jamestown, North Dakota. The new Lifetime Sports Facility is a joint project involving Jamestown college, the local YMCA, and the Jamestown community residents. The new facility will contain approximately 60,000 square feet of floor area including tennis courts, handball courts, basketball courts, locker areas for men and women, an indoor swimming pool, and office/administration areas.

48418 (HCP/M4131—01, pp 589-595) **Solar enery heating and cooling of an academic building on the Columbus Technical Institute Campus.** Jordan, R.W.; Pearson, R.J. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The solar energy heating and cooling system is being installed as part of new construction of a college building. The building will house classrooms, laboratories (photography, fire science and criminalistics), developmental education facilities, resource centers for hearing and visually impaired students, administrative offices and three lecture halls. The building will contain 33,830 net assignable square feet of area and 47,900 gross square feet of area. Evacuated tube collectors were used along with absorption chillers.

48419 (HCP/M4131—01, pp 597-605) **Troy-Miami County Public Library.** Pearson, R.J.; Minardi, J.E. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The building is a library, containing 23,200 sq ft of floor area, located in Troy, Ohio, 40°N Latitude. At the time the solar energy proposal was submitted, the construction of the building and its heating and cooling systems was nearly complete. Therefore, the system which has been installed in this building is a retrofit system. One-hundred and two Owens-Illinois evacuated glass tube collectors are utilized for the project, totaling 3,264 gross sq ft of collector area. The collectors are located on a south-facing sloping roof, which is inclined above the horizontal at 23.5°. However, the collector angle is 40° above the horizontal.

48420 (HCP/M4131—01, pp 607-611) **Solar system for Keith Keesecker Office Building, Sweet Home, Oregon.** Bliege, C.L. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This building is a two story office building with 4,000 sq. ft. of office space and a full basement of 2,000 sq. ft. The two upper floors each contain two offices. The basement is presently intended to be used as storage space. The collectors are flat-plate air collectors, mounted on a south-facing vertical wall. Air collectors are free from freezing problems and have been shown to perform more efficiently than liquid collectors. Much of the solar radiation available during the heating season in the Willamette Valley is diffuse radiation. It is a well known fact that flat plate collectors perform well under diffuse radiation conditions, therefore, flat plate collectors were selected.

48421 (HCP/M4131—01, pp 613-619) **Sullivans Island Elementary School solar heating and cooling demonstration project.** Clark, R.C.; Rast, G.B. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

Sullivans Island Elementary School is an existing building situated on Charleston Harbor on Sullivans Island, a suburb of Charleston, South Carolina. The school was constructed during the 1950's, and is of typical double loaded-corridor design with exterior and corridor walls being masonry loadbearing walls. Total building area is approximately 28,400 sq. ft., and solar conditioned area is approximately 22,000 sq. ft. Air conditioning has been added to the 22,000 square foot area, and existing air handling equipment will be utilized in the solar retrofit. Evacuated tube collectors were used.

48422 (HCP/M4131—01, pp 625-630) **Solar heating and cooling of Mount Rushmore National Memorial Visitor Center.** Chiang, C.W. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This project is a solar retrofit project of Mount Rushmore National Memorial Visitor Center at Keystone, SD, where over two million tourists visit each year. The Visitor Center has a total space of approximately 6,000 sq. ft. The solar system is designed to furnish approximately 45% of heating for the total facility, and approximately 53% partial cooling of the 2,000 sq. ft. observatory room. There are a total of 112 panels of Lennox liquid circulated collectors, each 3 ft. by 6 ft. in dimension, with a gross surface of approximately 2,000 sq. ft. The unit cost of the collector is about $13.00 per sq. ft. Collector panels are mounted in 5 1/2 rows on the roof of the Visitor Center owned by National Park Service of the Department of Interior.

48423 (HCP/M4131—01, pp 631-635) **Tennessee Building Materials Association Solar Energy System, Nashville, Tennessee.** Malloy, R.T. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The building is a three-story structure, consisting of an underground basement level, first and second floors. The basement arrangement was selected to take advantage of the excellent insulating charactistics of the ground. For the above-grade envelope, it was necessary to minimize the building heat loss and gains. The collectors selected are manufactured by Solar Unlimited, Inc., in cooperation with Halstead and Mitchell. The collector box is unique in that it is a composite sandwich of concrete and corrugated cardboard, which provides a high strength, high mass, low conductance structure with a minimum ambient life of 30 years.

48424 (HCP/M4131—01, pp 637-638) **Coca-Cola Bottling Works of Jackson, Inc., solar hot water and space heating system, Jackson, Tennessee.** Williamson, B. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

Coca-Cola Bottling Works of Jackson, Inc. was a recipient of a grant in the second cycle PON of the Demonstration Program. The system will be used for space heating and process hot water and will be retrofitted. Our 70,000 square foot production building will contain the solar system with 11,000 gross square feet of evacuated tube collectors on the roof. The system is designed to provide 50% of the space heating and process hot water load for the year. During the summer months the system should supply 100% of the energy required to heat the water used in the bottle washer.

48425 (HCP/M4131—01, pp 639-643) **One Solar Place - Dallas' first solar heated office building.** Anderson, K.; Burgesser, B. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

One Solar Place is an integrated new and retrofitted office building consisting of an existing one story building of 3,100 square feet and a two story, 7,200 square feet, addition which is currently being built. The building is scheduled for completion in December of 1978. The contemporary styling of the structure is accented by the redwood siding of the new addition which is blended with the red brick of the original office building. When completed, the project will be Dallas' first solar heated office building. The architectural design is an attempt to combine both active and natural (passive) solar technology and architecture in one integrated structure. The flat plate solar collector array has been sized to provide 100% of the domestic hot water requirement and 80% of the winter space heating. The system also includes provisions for a future expansion to include solar assisted cooling.

48426 (HCP/M4131—01, pp 645-648) **Solar heating and domestic hot water system, North Dallas High School, Dallas, Texas.** Arnold, F.P. Jr. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This system is designed as a retrofit in a three story with basement, brick masonry, concrete frame high school building. The building is 56 years old but is in excellent structural condition and is in the final stages of a $900,000.00 interior renovation. The building was air-conditioned with an electric drive 300 ton chilled water central system in 1973. The building contains 126,000 square feet and the flat plate solar system will preheat 100% of domestic hot water and supply 47.5% of annual building heating requirements.

48427 (HCP/M4131—01, pp 649-657) **Demonstration project, North Hampton Park Recreation and Health Center.** Burgesser, B.; Orlowski, H. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The building is an existing structure located on North Hampton Road in West Dallas consisting of a single story (two heights) enclosing a gymnasium, locker area and health care clinic surrounded by a recreational area and athletic field. The exterior of the building is brick veneer over masonry block. Out of 16,000 square feet of building under roof, 8,000 square feet is for gymnasium, which is presently heated and is not a part of the demonstration. The remaining portion of the building is owned by the City of Dallas Parks and Recreational Department and operated by the City of Dallas Building Services Department. The system consists of 3,650 sq. ft. of flat plate solar hydronic collectors, the LSC 18-15 collector as manufactured by Honeywell, Inc. The system has been designed to provide the facility with a combined annual energy savings for both heating and cooling of 556 x 10^6 Btu's or 54% of the total requirements.

48428 (HCP/M4131—01, pp 663-668) **Operating experience: the Trinity University solar heating and cooling project.** Treat, C.H.; Clark, G. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Trinity project is a retrofit of an existing central plant which provides space heating, space cooling and domestic hot water for the campus athletic center and five dormitories housing about 500 students. This solar energy system utilizes 16,080 square feet (lens area) of Northrup tracking, concentrating collectors and 40,000 gallons of hot water storage in two buried steel tanks. Solar powered cooling is provided by a 350 ton Carrier lithium bromide absorption chiller which was already in the central plant. Nonsolar cooling is now provided by a 630 ton electric centrifugal chiller installed as part of this project.

48429 (HCP/M4131—01, pp 669-675) **Solar assisted water source heat pump, La Quinta Motor Inn - Salt Lake City, Utah.** Orlowski, H. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

Flat plate collectors with double glazing were used along with a solar-assisted heat pump. The storage area consisted of 2,500 and 7,500 gallon steel tanks. (MOW)

48430 (HCP/M4131—01, pp 667-680) **Solar heating and cooling system for the Rutland Group building, Rutland, Vermont.** Beattie, M. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Rutland Group building is a combination office-warehouse facility for a design-build firm. The total building includes 4,800 square feet, 1,960 square feet of which is solar heated office space. The warehouse is heated only sporadically with a ceiling-hung oil-fired furnace. The building is a prefabricated steel building 12' high at the eave, with a nearly flat roof. It is built on concrete perimeter walls extending four feet below grade to a frostfree level. Within this wall and under the floor slab is a horizontal flow rock bed. The building incorporates what have now become standard energy-saving techniques such as triple glazing; air lock entry; adequate insulation, including foundation insulation and proper attention to siting to minimize wind impace while retaining maximum solar exposure. The solar collector occupies the entire south wall and roof of the heated space, leaving the east wall free for windows. This exposure allows a quick morning warm-up via passive direct gain. Flat plate air collectors are also used.

48431 (HCP/M4131—01, pp 693-698) **Renovation of Fauquier County High School solar heating system.** Liers, H.S.; McEver, W.S.; Harris, M.P.; Barbera, N.J. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

On 26 September 1978, ITC/Solar was awarded modifications of a previous DOE contract (No. EY-76-C-02-2586) for the purpose of renovating the Fauquier Country High School solar space heating system. The contract allowed replacement of outdated collectors with collectors that have incorporated more recent technological advances. The new collectors are more efficient, more aesthetically pleasing, and will drastically reduce system maintenance. Installation of the collectors was personally executed by ITC/Solar engineering staff and has resulted in a blend of construction and design experience extremely valuable in product development. As a direct result, a number of design changes have been implemented and more are under consideration. This installation has also provided an excellent opportunity for evaluating a working system using currently marketed collectors. Monitoring and evaluation provided for in the modification is ongoing.

48432 (HCP/M4131—01, pp 699-705) **Performance of a solar assisted heat pump system for office building.** Moseley, T.D. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The system is a 400 sq. ft. (gross) drain down single glazed non selective flat plate collector with a 2,000 gallon storage tank. It was retrofitted into a 1,780 sq. ft. office building. A hot water duct coil supplies space heat when storage temperatures are above 90 to 95°F. Back up heat is provided by a gas boiler. Hot water is preheated before going to an electric water heater. The building has a design heat loss of 32,200 Btuh (net is 25,200 when considering internal loads and 0°F outdoor temperature) and is located in Lynchburg, Virginia, where 4160 degree days is normal for the average winter. Percent of possible sunshine hours is 59 for the normal year, and averages 53 for December thru February.

48433 (HCP/M4131—01, pp 707-709) **Solar energy: a psychiatric hospital project.** Weinstein, M.E. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The original physical plant is a one-story brick faced building constructed as a nursing home and in recent years converted for use as a psychiatric hospital. It is anticipated that the solar system will satisfy 71% of the total hospital's hot water requirements. The solar space heating will be provided in 8,020 sq. ft. of patient living areas. The solar system utilizes a single glazed selectively coated flat plate collector manufactured by Sunworks. The major innovation in this system is a dual source or hybrid heat pump that can utilize both outside air and solar heated water as a source of heat.

48434 (HCP/M4131—01, pp 711-720) **Report on Project Sunburst: a Department of Energy commercial solar demonstration at Richland, Washington.** Ripley, C.C.; Poplin, R.S. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

A current Olympic Engineering Corporation project for the Department of Energy is the operation and demonstration of a solar space heating, space cooling, and domestic water heating system in our 14,400 square foot Project Sunburst office building at Richland, Washington. The system is designed to provide 71 percent of the space heating, 97 percent of the space cooling, and most of the domestic water heating required for year round operation of the building. An array of 6,000 square feet of roof-mounted ethyleneglycol/water cooled General Electric flat plate collectors supplies energy through a heat exchanger to an underground insulated 9,000 gallon thermal energy storage tank. Hot water is pumped directly from TES to 8 water-to-air coils in the forced air duct work on demand by 8 zone thermostats in the winter. A 25 ton solar hot water driven Arkla absorption chiller cools water in a 2,000 gallon storage tank to supply cold water to the same water-to-air coils in the summer.

48435 (HCP/M4131—01, pp 721-728) **Solar heating and cooling system for the Page Jackson Elementary School.** Spalding, M.A. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The school is a conventional single story, flat roof design consisting of 52,000 ft^2 of floor space. Flat plate collectors were used for space heating and cooling. (MOW)

48436 (HCP/M4131—01, pp 729-734) **Active solar heating system for warming hog farrowing building and drying vertically stored shelled corn in southwest Wisconsin.** Feyen, J.P. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The hog building is a remodeled dairy barn with a concrete block foundation and first floor walls, and a twenty-two foot attic of frame construction, enclosed with laminated arched rafters. The arch is approximately 30° sectioned from a circle of 20 ft. radius. The hogs are housed in the 1500 ft^2 first floor. That is the only space that requires heat. The entire 1200 square feet of collector is actually an array of two six hundred square foot collectors measuring 24' x 25'. The entire two hundred cubic feet of heated air in a single collector is moved out of the collector by a one-quarter hp fan and is blown directly into the barn and to the point of use through a network of strategically placed four-inch plastic tubing buried in concrete within the structure of the building. Each of the two fans charges approximately 175 lineal feet of tube with heated compressed air. The air leaves the four-inch tube through uniformly spaced two-inch vertical stacks which open the tubing to the heated environment.

48437 (HCP/M4131—01, pp 735-742) **Lakeshore Technical Institute solar heated equine management training center.** Groth, G. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The building as proposed is T-shaped. The top of the T runs north and south and is placed to the west of the leg which runs east and west. The "T-top" section is 150' long north to south and 90' wide. It encloses an unheated training arena. The leg is 120' long west to east and 60' wide. This portion encloses 4,560 sq. ft. of area to be used for housing 20 horses in stalls, a tack room and feed mow. The winter interior design temperature for the stall area is 50°F. The remaining 2,640 sq. ft. area contains a judging/classroom, office, laboratory, toilets and other areas to be used by students and instructors. This "people" space has a winter design temperature of 70°F. The solar system proposed to meet the needs will use 735 sq. ft. (aperture area) of air type flat plate collectors.

48438 (HCP/M4131—01, pp 743-744) **Passive solar office building in Laramie, Wyoming.** Barker, J.W. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

A passive solar building with office and workshop space for which the predicted solar contribution for space heating exceeds 90% in an 8750 degree day climate has been designed. Hollow precast concrete slabs filled with water serve as walls, as thermal storage, and as the thermal distribution network.

48439 Differential thermostatic controller for solar heating system. Nurnberg, R.K. (to Robertshaw Controls Co.). US Patent 4,116,219. 26 Sep 1978. Filed date 22 Apr 1976. 12p.

A controller for a solar heating system includes a differential thermostat which responds to a preselected temperature differential between fluid in a solar collector and in a storage tank to operate a motor to pump fluid therebetween. The particular circuitry of the thermostat allows the use of non-linear sensing devices. Safety features includable in the controller provide for sensing of high and low extreme temperature conditions to prevent excess pressure in the storage tank or freezing of water in the collector.

AGRICULTURAL AND INDUSTRIAL PROCESS HEAT

REFER ALSO TO CITATION(S) 48104, 48265

48440 (JPL-PUB—78-25) **Solar energy for process heat: design/cost studies of four industrial retrofit applications.** French, R.L.; Bartera, R.E. (Jet Propulsion Lab., Pasadena, CA (USA)). 1 Apr 1978. 61p. California Energy Resource Conservation and Development Commission, Sacramento, CA.

Five specific California plants with potentially attractive solar applications were identified in a process heat survey, conducted by JPL. The plants were the Joseph Schlitz Brewery, Crown Zellerbach Paper Manufacturing, Carnation Milk Company, Los Angeles Soap Company, and Pacific Vegetable Oil International. These five plants were visited, process requirements evaluated, and conceptual solar system designs were generated. JPL obtained the services of A.C. Martin and Associates to make preliminary layout drawings and generate installation cost estimates for four of the plants. From the refined A.C. Martin designs, JPL conducted studies to determine expected thermal and economic performance. A cost estimate for the fifth system was made by extrapolating from data in the A.C. Martin estimates and other available DOE work. Four DOE (ERDA) sponsored solar energy system demonstration projects were also reviewed and compared to the design/cost cases included. In four of the five cases investigated, retrofit installations providing significant amounts of thermal energy were found to be feasible. The fifth was rejected because of the condition of the building involved, but the process (soap making) appears to be an attractive potential solar application. Costs, however, tend to be high ranging from 12.00 to 26.00 $/10^6 Btu after taxes. Several potential areas for cost reduction were identified including larger collector modules and higher duty cycles.

48441 (SERI/RR—34-152) **SERAPH implementation plans.** Castle, J.; Su, W.; Dougherty, D.A.; Wright, J.D. (Solar Energy Research Inst., Golden, CO (USA)). May 1979. Contract EG-77-C-01-4042. 45p. Dep. NTIS, PC A03/MF A01.

The Solar Energy Research Institute (SERI) devotes a significant research effort to the application of solar technology in the industrial sector. It is well known that US industries consume a significant amount of energy, a large portion of which is required in a temperature range in which concentrating solar collectors work effectively. The SERAPH facility (Solar Energy Research and Applications in Process Heat) will provide at SERI the capability of addressing many of the technical issues that currently hamper industrial solar thermal energy system implementation. The primary building blocks of SERAPH are the solar delivery subsystem, control, and data acquisition subsystem (including sequencing and emergency supervision), energy distribution subsystem and two physical areas set aside for storage development and the introduction of load devices. Emphasis has been placed on creating a versatile test facility within which the solar industry can work with SERI in the development of solar systems that will be attractive to potential industrial users. SERAPH will have an initial capability of producing steam at a rate of 900 lb/h (410 kg/h) which corresponds to an energy delivery rate of 1.5 million Btu/h (1.6 x 10^6 kJ/h) at 430°F (220°C) with expansion capability to approximately 600°F (315°C). The initial system controls will be analog with supervisory and direct digital control to follow. The issues to be addressed at SERAPH will be computer predictive model validation and refinement, control strategy development, solar equipment evaluation, and the accumulation of operating and maintenance experience. A consistent theme throughout the planning and operation of SERAPH is the need to develop and follow practices that are consistent with conventional industrial operating procedures.

WATER HEATING

REFER ALSO TO CITATION(S) 48293, 48339, 48340, 48341, 48343, 48344, 48345, 48350, 48351, 48354, 48355, 48356, 48361, 48362, 48366, 48369, 48370, 48371, 48373, 48374, 48375, 48376, 48378, 48379, 48381, 48382, 48383, 48385, 48387, 48389, 48391, 48396, 48397, 48399, 48400, 48405, 48406, 48407, 48408, 48412, 48413, 48414, 48415, 48417, 48423, 48424, 48425, 48426, 48427, 48428, 48429, 48432, 48433, 48434, 48437

48442 (HCP/M4131—01, pp 33-37) **Solar hot water heating system: Thompson Motor Inn (Best Western) and restaurant, Taylor, Texas.** MaCuk, B.W. Jr. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The system uses 1,232 sq. ft. of flat plate collectors to heat water for the motel and restaurant. A 2,000 gallon steel storage tank is used in the system. Some operational experience is discussed. (MOW)

48443 (HCP/M4131—01, pp 163-169) **Design considerations for a large passive water heating system in Hawaii.** Bean, M. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This paper deals with the design which has been done on the Nuuanu YMCA solar water heating system. The design is for a large scale thermosyphon water heating system (2,422 square feet of collectors) on one roof, and a 727 square foot pumped system on an adjacent roof circulating through the same tank, using a proportional pumping system. The thermosyphon system will incorporate specular reflectors; the pumped system will be installed with horizontal collectors and a vertical diffuse white wall reflector.

48444 (HCP/M4131—01, pp 171-174) **Solar heated processing water for photographic laboratory.** Nitta, H. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Solar Heated Processing Water for the Photographic Laboratory was designed to supply six different processing machines with hot water at varying temperatures between 80 and 120 degrees F. These machines are used for different types of processes and are not usually run simultaneously or continuously. Analysis showed that a system providing six gallons per minute of 120 degrees F and nine gallons at 90 degrees F for an eight-hour day with water supplied at 60 degrees F would be adequate for the temperature ranges and quantities required. This represents a total energy requirement of 2.5 x 10+8 Btu per year. The collector array is designed to supply 80% of the annual requirement and will be installed in parallel with the existing two gas fired boilers so that the latter can serve as the backup system when prolonged inclement weather conditions persist.

48445 (HCP/M4131—01, pp 179-184) **Solar heated service hot water.** Tipton, J.A. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Bartlesville (Oklahoma) Engergy Technology Center was awarded a "Solar Demonstration Project" in 1977. The solar unit is used to heat the domestic hot water in a large laboratory/office building. The building has 52,000 ft^2 of floor area; approximately 30,000 ft^2 is utilized for laboratories and offices. Ancillary spaces include mechanical rooms, an auditorium, a conference room, corridors, storage space, and restrooms. This building accommodates about 75 employees. An estimated 1,700 gallons of hot water provide the daily needs of the laboratories and restroom facilities. The flat plate collector area chosen was 585 sq. ft.

48446 (HCP/M4131—01, pp 195-199) **Solar demonstration project: Reynolds Metals shower and change facility.** Foster, W.W. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The building (located in Sheffield, Alabama) is a shower and change facility similar to those widely used in industry. The facility contains 37 showers and 210 lockers. It has 3,534 square feet of floor space and 3,446 square feet of wall space. The building has double walls constructed of concrete blocks with styrofoam insulation between the walls. The building, designed for a solar retrofit, was oriented in a north/south direction and all structural and piping penetrations were installed in the roof. The flat plat solar system was designed to provide 79% of the estimated annual space heating load and 59% of the estimated annual potable hot water requirements. Backup space heat and hot water are provided with with a 160 kW electric resistance heater and six 120 gallon electric hot water heaters rated at 15 kW each.

48447 (HCP/M4131—01, pp 215-224) **Solar hot water demonstration project (industrial laundry).** Burnett, E.S. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This project was designed and implemented as a total conservation system to preheat incoming city water for use in the Red Star Industrial Service Laundry in Fresno, California. Comprising two (2) major subsystems—a waste-water heat recovery subsystem and a flat-plate solar collector subsystem with independent storage—the total system was designed to reduce fossil fuel consumption for hot water supply to the laundry by 50%. The wastewater heat recovery subsystem was supplied by Heat Recovery Systems, Inc., Paramount, California, who also participated in the overall system design. A total of 140 single-glazed flat-plate liquid collectors with a nominal area of 6,500 square feet and a 12,500 gallon fiberglass storage tank were supplied by Ying Manufacturing Corporation, Gardena, California.

48448 (HCP/M4131—01, pp 305-311) **Wilmington Swim School solar system.** Breck, T.T.; Cooperson, J.N.; Kursh, S.J. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Wilmington Swim School serves the Wilmington metropolitan area with instructional and competitive aquatic programs and hosts swimming meets. Swim School students have achieved national recognition. The facilities contain 20,650 gross square feet on two levels; 12,400 square feet constructed in 1964 and 8,250 square feet in a just completed addition. The active solar system is an open loop drain-back potable water collector configuration with 2,500 sq. ft. flat plate all copper collectors mounted in two banks. Design criteria are presented.

48449 (HCP/M4131—01, pp 359-362) **Ramada Inn Solar Water Heating Project, Honolulu, Hawaii.** Pressler, T.E. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The Ramada Inn Solar Heating Project consists of 3,600 square feet net aperture area of flat plate collectors mounted on the roof of an existing 210 room hotel building. Existing gas-fired water heaters will remain in operation for standby hot water heater set point. The existing roof will also be utilized for a solar hot water storage tank.

48450 (HCP/M4131—01, pp 529-535) **Solar hot water system for the Coachlight Motel in Las Cruces, New Mexico.** Cooper, T.J. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

Since the Coachlight Inn in Las Cruces is comprised of three separate buildings (building 1 has 32 units, building 2 has 40 units including motel laundry system, and building 3 has 36 units), it was necessary to design a solar hot water system which not only minimized installation costs but also maximized the cost efficiency of usable generated Btu's as a function of installation cost. Flat plate collectors were used.

48451 (HCP/M4131—01, pp 621-624) **Days Inns of America, Inc. solar hot water system, Anderson, South Carolina.** Coley, M.Q. Jr. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

A low rise two story 114 room motel was retrofitted with 750 square feet of flat plate solar collector to provide a portion of the energy required for service hot water. The system was designed to provide 40% of the total demand.

48452 (HCP/M4131—01, pp 659-662) **Solar domestic water heating system, La Quinta Motor Inn, Texas City, Texas.** Davis, W.B. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The flat plate collectors were single glazed and covered 2,000 ft^2. A 2,500 gallon unlined steel storage tank was used. (MOW)

48453 (HCP/M4131—01, pp 681-688) **Performance of the solar water heating systems on the Econo-Travel Motor Hotels.** Allred, J.W. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This paper gives the initial performance data of two soalr hot water heating systems now in operation and installed with a grant under DOE's hotel/motel solar demonstration program dated May 12, 1977. One other system is now in operation with two others in process. System locations are Hampton, Chesapeake, Woodbridge, Richmond, Va., and Bluefield, West Virginia. All hotels have two levels with flat roofs which make for ease of proper orientation of collectors to obtain maximum insolation.

48454 (HCP/M4131—01, pp 689-691) **Charles S. Monroe Vocational Technical Center solar domestic hot water system, Loudoun County, Virginia.** Bridges, L.B. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

The building is a one-story structure containing a total gross area of 78,000 square feet. Stainless steel flat plate collectors were used along with 2,000 and 1,000 gallon storage tanks.

OTHER

REFER ALSO TO CITATION(S) 48436

SOLAR COLLECTORS AND CONCENTRATORS

REFER ALSO TO CITATION(S) 48292, 48293, 48330, 48334

48455 (CONF-790570—1) **Stability of plasma-sprayed coatings tested at White Sands Solar Facility.** Schreyer, J.M.; Hays, R.A.; Schmitt, C.R.; Farwell, D. (Oak Ridge National Lab., TN (USA); Oak Ridge Y-12 Plant, TN (USA); White Sands Missile Range, NM (USA)). 1979. Contract W-7405-ENG-26. 9p. (CONF-790541—10). Dep. NTIS, PC A02/MF A01.

From Solar Thermal Test Facility Users Association experiments workshop; Albuquerque, NM, USA (3 May 1979).

Plasma-sprayed coatings on steel plates were tested at the White Sands Solar Facility at temperatures from 200°C to 1000°C. Analysis of the specimens before and after testing showed erbium dodecaboride (ErB_{12}), yttrium hexaboride (YB_6), titanium diboride (TiB_2), and chromium oxide (Cr_2O_3) to be stable above 600°C. A heat balance on the water-cooled specimens of these coatings showed 73% to 97% heat recovery efficiency.

48456 (COO—4297-1) **Corrosion protection of solar-collector heat exchangers with electrochemically deposited films. First semi-annual report, May 15—November 30, 1978.** Brummer, S.B.; Koch, V.R.; Schnaper, G.H. (EIC Corp., Newton, MA (USA)). Jan 1979. Contract EM-78-C-04-4297. 44p. Dep. NTIS, PC A03/MF A01.

Work on this program involves the demonstration of a novel corrosion protection technique for the common solar collector metals: Al, Cu, and Fe as mild steel. This involves the potentiostatic electrochemical deposition of thin, adherent polymer films on the interior of heat-exchanger tubes by application of a current in the presence of a suitable dissolved organic monomer. Anodic film formation on Al can only take place in the absence of its Al_2O_3 coating. The Zn immersion process effectively replaces the oxide with a thin coating of Zn. Subsequent electroorganic monomer polymerization thus ensues on a Zn surface. Tetramethylphenol (TMP) has been shown to film Al/Zn samples, and ESCA and infrared analysis reveal a methylated polyphenylene oxide polymer although complete coverage was not achieved. Copper and iron readily accomodate dimethylphenol (DMP) and metaphenylenediamine (MPD) as well as TMP films. As in the case of Al, holidays or cracks in the film were apparent via ESCA analysis thus precluding good corrosion protection.

48457 (DOE/JPL—1060-12) **Parabolic concentrating collector: a tutorial.** Truscello, V.C. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Feb 1979. Contract EX-76-A-29-1060. 48p. (JPL-PUB—79-7). Dep. NTIS, PC A03/MF A01.

A tutorial overview of point-focusing parabolic collectors is presented. Optical and thermal characteristics of such collectors are discussed. Data representing typical achievable collector efficiencies are presented and the importance of balancing collector cost with concentrator quality is argued through the development of a figure of merit for the collector. The impact of receiver temperature on performance is assessed and the general observation made that temperatures much in excess of 1500 to 2000°F can actually result in decreased performance. Various types of two-axis tracking collectors are described, including the standard parabolic deep dish, Cassegrainian and Fresnel, as well as two forms of fixed mirrors with articulating receivers. The present DOE program to develop these

devices is briefly discussed, as are present and projected costs for these collectors. Pricing information is presented for the only known commercial design available on the open market.

48458 (LA-UR—79-1336) **Characterization of crushed glass as a transpired air heating solar collector material.** Collier, R.K. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 6p. (CONF-790541—7). Dep. NTIS, PC A02/MF A01.

From International Solar Energy Society meeting; Atlanta, GA, USA (28 May 1979).

The use of crushed glass matrices as the heat-absorbing media in air heating solar collectors is investigated. An experimantal program was undertaken to characterize the most likely candidate glass types and sizes by measuring pressure drops, optical extinction coefficients, and volumetric heat transfer coefficients. Bed efficiencies were also measured and found to be similar to those expected for screen matrices unless critical amounts of clear glass were used as a top layer, which results in lower efficiency.

48459 (SAND—78-2183) **Compendium of solar-thermal collector procurement activities at Sandia Laboratories.** Randall, D.E. (Sandia Labs., Albuquerque, NM (USA)). May 1979. Contract EY-76-C-04-0789. 36p. Dep. NTIS, PC A03/MF A01.

This report provides a single compendium of information about three major solar thermal collector procurement cycles and two special sole-source procurements undertaken by Sandia Laboratories. A summary of the experience and lessons learned from these activities is included.

48460 Process for the electrolytic formation of lead dioxide solar absorption coating. Schmidt, F.J. (to Ametek, Inc.). US Patent 4,139,426. 13 Feb 1979. Filed date 7 Jul 1977. 6p.

A solar energy collector surface, the effectiveness of which as a collector is relatively independent of incident angle, comprises a textured surface of lead dioxide electrodeposited in such a manner to produce a multiplicity of upwardly protruding platelets. The electrode-position technique comprises an initial nucleation stage in which a relatively high overpotential is applied for a short period of time and a subsequent oriented growth stage in which a lower overpotential is applied for a longer period of time than in the first stage.

48461 Solar heat collecting module and modular system. Lane, G.T. US Patent 4,136,699. 30 Jan 1979. Filed date 16 May 1977. 10p.

A versatile, low cost solar heat collecting module made up of a minimum of presized basic parts has a cover portion for passing solar energy into an inner cavity where it is absorbed by a collector plate and converted to heat which in turn heats a stream of air in a flow passage along the back face of the collector plate. Manifold portions at the ends facilitate the moving of a stream of air through each module and an array of interconnected modules are arranged side-by-side in such a way that the flow path for air from inlet to outlet for the array is substantially the same distance. A heat-washing means projects into the flow passage from the back side of the collector plate to cause a turbulence in the air stream, the heat-washing means being provided by a support strap for supporting the collector plate that is bent to project into the flow passage and place a tension in the support strap and collector plate.

48462 Manifold arrangement. Heitland, H.; Grundmann, E.; Kroll, R. (to Volkswagenwerk Aktiengesellschaft). US Patent 4,135,492. 23 Jan 1979. Priority date 7 Nov 1975, German, Federal Republic of (F.R. Germany), 8p.

An inlet and/or outlet manifold arrangement for use with a conduit system of a solar radiation collector is described. The arrangement has inlet and outlet manifolds which are held in a given position and which are connected to the conduit system, there being an inlet communicating with the inlet manifold and an outlet communicating with the outlet manifold. At least the inlet manifold is equipped with a riser having a height such that when the pressure in the conduit system exceeds a predetermined value, the riser serves as an overflow which allows liquid to escape from the inlet manifold and to flow into the outlet manifold.

48463 Sunlight admitting heat impeding panel. Graf, R.E. US Patent 4,131,706. 26 Dec 1978. Filed date 21 Dec 1976. 8p.

A process with minor variations for producing a configuration of glass and/or any similar material such as plastic or epoxy is disclosed. The configuration is basically a honeycomb of pipes of transparent material attached to a transparent plate, such as window glass. The pipes are closed at one end by the plate. Then pipes prevent convection movement of a fluid parallel to the plate near its surface, except for very short distances. The unique inventive feature of the process lies in the fact that the honeycomb of pipes are produced simultaneously by a drawing process, during which either a part of a plate, which part is in the form of a grid, is softened, or a grid of new soft material is added to a plate, and the pipes are always attached to the plate both during formation and upon completion of formation. Also disclosed is a special configuration to render the pipes resistant to breakage under thermal stress. This special configuration for the honeycomb design can be applied equally well in other areas such as ceramic catalytic converters, heat exchangers, and thermoelectric air conditioners.

48464 Heat collecting and transferring apparatus and systems adapted for use with solar energy. Klank. B.E.O.; Jensen, J.R. US Patent 4,127,103. 28 Nov 1978. Filed date 21 Dec 1976. 10p.

Heat energy as from solar rays is colected by units including transparent plates covering a completely liquid filled chamber which has a heat absorbing layer as the internal surface of the chamber. The liquid is transparent and capable of absorbing, storing and/or transporting the heat energy. In one embodiment, the heat is removed to a storage tank from many such collector units by pumping. The system can allow draining of the collector when heat collection conditions do not prevail. In another embodiment of collector, the heat is transferred through the heat absorbing walls and the liquid medium acts mainly as a heat receiver and storing facility. A compartmentalized tank can be employed to enhance heat collection efficiency.

48465 Solar energy collector including a weightless balloon with sun tracking means. Hall, F.F. US Patent 4,126,123. 21 Nov 1978. Filed date 24 Feb 1977. 10p.

A solar energy collector is described having a weightless balloon, the balloon including a transparent polyvinylfluoride hemisphere reinforced with a mesh of ropes secured to its outside surface, and a laminated reflector hemisphere, the inner layer being clear and aluminized on its outside surface and the outer layer being opaque, the balloon being inflated with lighter-than-air gas. A heat collection probe extends into the balloon along the focus of reflection of the reflective hemisphere for conducting coolant into and out of the balloon. The probe is mounted on apparatus for keeping the probe aligned with the sun's path, the apparatus being founded in the earth for withstanding wind pressure on the balloon. The balloon is lashed to the probe by ropes adhered to the outer surface of the balloon for withstanding wind pressures of 100 miles per hour. Preferably, the coolant is liquid sodium-potassium eutectic alloy which will not normally freeze at night in the temperate zones, and when heated to 4,000°R exerts a pressure of only a few atmospheres.

48466 Grille-shaped absorber for solar collectors to utilize solar energy. Jokubeit, W.; Jaschniski, H. (to Jokubeit (W.) Herstellung und Entwicklung von Bauteilen und Geraeten, Hofolding (Germany, F.R.); Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,719,832/A/. 16 Nov 1978. 7p. (In German).

The invention applies to an absorber with special plates of different materials that are arranged like a Venetion blind and are adjustable in order to enlargen the absorption surface. The absorber may be installed in a solar collector. The heat transfer medium flows through a thin walled tube system fastened to the above plates. The plates are bent on one side in order to catch radiation.

48467 Nonimaging radiant energy direction device. Winston, R. (to Dept. of Energy). US Patent Application 945,923. 26 Sep 1978. 17p.

A nonimaging radiant energy light direction device is provided which may be utilized for both the collection and transmission of radiant energy. The device includes an energy transducer and at least one reflective wall of particular contour. The particular contour is determined by assuming the transducer is acting as an incoherent Lambertian radiant energy emitter of finite dimension. The reflective wall is placed along a flow line of the geometrical vector flux associated with such an emitter. The ideal contour will also satisfy the condition that the rays of radiant energy are in a state of detailed balance along the mirror. Both trough shaped and cone like direction devices can be developed from this design method.

48468 Solar sensor and tracker apparatus. Winders, G.R. US Patent 4,107,521. 15 Aug 1978. Filed date 14 Oct 1976. 10p.

Improved solar sensor and tracker apparatus is described in which an extremely low cost high angular accuracy sensor and tracking device utilizing a symmetrical sensor shade and sensor arrangement is described. An improved circuit control for electric motor drive of the tracker apparatus is also described in which a relatively high speed track operation followed by a relatively slow speed homing in motion is automatically provided by the control circuit driving the electric motors.

48469 Heat absorber for a solar collector and method of production. Heidtmann, U. (to Brown, Boveri und Cie A.G., Mannheim (Germany, F.R.); Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,657,468/A/. 22 Jun 1978. 9p. (In German).

The invention deals with a heat absorber for a solar collector with plastic collector channels for a heat carrier and a method of production. The flow and collector channels are connected in such manner that high stability is achieved with a simple construction. Constructional details are given.

48470 Solar collector. Dick, G. (to Vereinigte Aluminium-Werke A.G., Bonn (Germany, F.R.); Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,651,602/A/. 24 May 1978. 9p. (In German).

A solar collector is described. The collector sheet has roll-formed flanges with a parabolic surface. In the focal plane of the flanges which act as parabolic mirrors, there is a hollow fin enclosing a flat heat transfer tube. The back of the collector sheet is thermally insulated by means of foamed plastics.

48471 Solar collector made of reinforced concrete. Gleissner, A. (to Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,637,451/A/. 23 Feb 1978. 4p. (In German).

The solar collector registered here consists of a single grain layer of concrete which has black colouring material added to it. The layer of concrete has a glass cover on the sun's side. On the lower side there is an aluminium foil and below that a heat barrier. As single grain concrete layers permit water to penetrate them, the solar heat can be transmitted to the consumer using water. In order to prevent cracking of the layer of concrete, a steel reinforcement is added during manufacture.

48472 Solar energy collector. Bieringer, R.J.; Mather, G.R. Jr. (to Owens-Illinois, Inc., Toledo, OH (USA); Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,735,954/A/. 23 Feb 1978. 33p. (In German).

A vacuum tube collector system is described. A cylindrical mirror reflector without an image is used as reflector, in order to be able to collect diffused light such as light radiation effectively. Apart from this, the reflector is constructed so that following of the sun is not necessary. Technical details of the design of the reflector and of the absorber tube are laid down in 17 patent claims.

48473 Solar heating aggregate and heat exchanger plate. Safdari, Y.B. (to Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,726,344/A/. 16 Feb 1978. 15p. (In German).

A solar collector, in particular for gaseous media, is described. For a good heat transfer between the absorber plate and the heat transport medium air, the absorber plate has bars at its back so that the heat exchange surface will be sufficiently large. The bars are designed to avoid unnecessary flow losses.

48474 Automatic filling and emptying of solar collectors. Krumpe, A. (to Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,614,142/A/. 16 Feb 1978. 5p. (In German).

A method is described by which collector systems can be automatically filled and emptied in order to avoid freezing. The arrangement works with a level vessel where the maximum water level is lower than the lower collector feeding line which is in danger of freezing. The collector is filled and emptied automatically via a separate circuit by means of a magnetic valve and a pump.

48475 Comment on the article economy of various control devices for oil- and gas-fired hot water heating plant in house construction. *HLH, Z. Heiz., Lueftung, Klim., Haustech.;* **29**: No. 2, 80-85(Feb 1978). (In German).

From the author's own examples and the East German results, which are also of interest, an average saving of 15% can be assumed for ambient-temperature forward flow control. Installation of thermostat valves results in a further 10% reduction of energy consumption. A total saving of about 25% by a combination of ambient-temperature flow control and thermostat valves is, therefore, quite a success from a realistic point of view. Over-optimistic statements on possible savings, which may be derived from specific examples but are not representative, should be avoided.

48476 Use of floating solar collectors in processing iceberg water. Cluff, C.B. (Univ. of Arizona, Tucson). pp 474-479 of Iceberg utilization. Husseiny, A.A. (ed.). Elmsford, NY; Pergamon Press, Inc. (1978).

From 1. international conference and work shops on iceberg utilization for fresh water production, weather modification and other applications; Ames, IA, USA (2 Oct 1977).

A floating tracking platform equipped with parabolic collectors concentrating sunlight on photovoltaic cells is described. The unique tracking system made possible by using a floating platform allows for the construction of inexpensive low-profile concenrating collectors. The concentrating collectors would focus concentrated sunlight on a bank of photovoltaic cells. These cells must be cooled for maximum efficiency. This type of collector, under development at the University of Arizona, could be floated next to a moored iceberg to provide waste heat for melting the ice. This combination should improve the efficiency of the photovoltaic cells and reduce the costs of ice-to-water conversion. This coupled system would make it possible to provide both water and power to arid coastal areas.

48477 Solar collector. Ulli, E.; Amann, H. (to Arbonia A.G., Arbon (Switzerland); Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,618,467/A/. 10 Nov 1977. 10p. (In German).

A solar collector is described, which is distinguished from the usual systems by having a space absorber and covering plates at a slight vacuum, and which is filled with a gas with low thermal conductivity e.g. argon, carbon dioxide or a fluorised cooling medium. This achieves the result that the radiation losses are reduced.

HEAT STORAGE

48478 (BNL—26216) **Computer simulation of ground coupled storage in a series solar assisted heat pump system.** Andrews, J.W.; Metz, P.D. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 5p. (CONF-790541—25). Dep. NTIS, PC A02/MF A01.

From International Solar Energy Society meeting; Atlanta, GA, USA (28 May 1979).

A quantitative study of the effect of thermal coupling between the ground and the heat storage element of a series solar assisted heat pump system is presented. The transient simulation computer program TRNSYS is used to simulate the solar portion of this system. A program to simulate the thermal interaction of the storage element with the ground is incorporated into TRNSYS as a sub-routine. This program calculates heat flow through the ground in discrete steps over space and time. Boundary conditions are established. The ground coupled storage is driven by thermal inputs from the solar portion of the system and from the changing ambient and ground temperatures.

48479 (BNL—26219) **Experimental results from the solar ground coupling research facility at Brookhaven National Laboratory.** Metz, P.D. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 5p. (CONF-790541—27). Dep. NTIS, PC A02/MF A01.

From International Solar Energy Society meeting; Atlanta, GA, USA (28 May 1979).

The results of the first half year of operation of the solar ground coupling research facility at Brookhaven National Laboratory (BNL) are presented. We analyze the data from the eight original experiments which are first generation ground coupled heat transfer and storage devices for a solar source heat pump system. A computer model of the heat transfer between these devices and the earth is discussed.

GEOTHERMAL ENERGY

REFER ALSO TO CITATION(S) 48750

RESOURCE STATUS AND ASSESSMENT

USA

REFER ALSO TO CITATION(S) 49178, 49194

48480 (LBL—8703) **Geothermal energy development from the Salton Trough to the High Cascades.** Goldstein, N.E. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jan 1979. Contract W-7405-ENG-48. 15p. (CONF-790107—10). Dep. NTIS, PC A02/MF A01.

From 3. national conference and exhibition on technology for energy conservation; Tucson, AZ, USA (22 Jan 1979).

The program in Geothermal Energy Development at the Lawrence Berkeley Laboratory is reviewed briefly. Current work in two contrasting geological environmts is discussed. These are the Cerro Prieto Geothermal Field and Mt. Hood volcano. (MHR)

48481 Preliminary analysis of the energy and water requirements for developing geothermal energy in Arizona. Norton, D.L.; Gerlach, T.M. (Univ. of Arizona, Tucson). pp 106-121 of Proceedings of conference on water requirements for lower Colorado River Basin energy needs. Phoenix, AZ; Arizona State Fuel and Energy Office (1975).

From Conference on water requirements for lower Colorado River Basin energy needs; Tucson, AR, USA (8 May 1975).

There are several regions in Arizona that have very high potential for the discovery of conventional geothermal reservoirs. Geothermal energy based power systems have 2 distinct advantages over current energy production: (1) resource development and delivery to the plant site consume small amounts of energy, and (2) the recovery of the resource has a minor impact on man's environment. Water is also a natural by-product of geothermal energy use. Desali-

nation plants coupled to the geothermal fields could produce about 50% of the potable water for the region. A 2000 megawatt geothermal energy development would require about 2% of the total water used in Arizona.

GEOLOGY, HYDROLOGY, AND GEOTHERMAL SYSTEMS

REFER ALSO TO CITATION(S) 49288

48482 (CONF-790580—1) **Chemistry and materials in geothermal systems.** Miller, R.L. (Idaho National Engineering Lab., Idaho Falls (USA)). 1979. Contract EY-76-C-07-1570. 11p. Dep. NTIS, PC A02/MF A01.

From ACS/CSJ chemical congress; Honolulu, HI, USA (4 May 1979).

The development of a geothermal fluid, from its origin as meteoric water precipitating on the earth's surface, as it flows through the soils and rocks of geological formations, to the point where it returns to the surface as a hot spring, geyser, well, etc. is traced. Water of magmatic origin is also included. The tendency of these hydrothermal fluids to form scales by precipitation of a portion of their dissolved solids is noted. A discussion is presented of types of information required for materials selection for energy systems utilizing geothermal fluids, including pH, temperature, the speciation of the particular geothermal fluid (particularly chloride, sulfide and carbon dioxide content) and various types of corrosive attack on common materials. Specific examplers of materials response to geothermal fluid are given.

USA

REFER ALSO TO CITATION(S) 48508

48483 **Volatiles, magma mixing, and the mechanism of eruption of Augustine Volcano, Alaska.** Johnston, D.A. Seattle, WA; Univ. of Washington (1978). 187p. University Microfilms Order No. 78-14,447.

Thesis (Ph. D.).

After approximately 120 days of precursor seismicity and probable steam explosions, the 1976 eruption of Augustine Volcano, a calc-alkaline stratovolcano in Cook Inlet, Alaska, began January 22, 1976 with two small ash explosions. During the following three days, three major explosions produced pumiceous nuees ardentes, a pyroclastic surge, and widespread regional ash-fall. More than 10 smaller eruptions also occurred, but did not produce ash deposits or significant fall out, and may have been steam explosions involving groundwater. During subsequent activity in February and April, 1976, the intensity of the eruptions rapidly declined, and the mechanism of emplacement of pyroclastic flows changed. Roughly 0.17 km^3 of rock was erupted in 1976, of which about 27% was erupted in January, 59% in February, and 14% in April. Fifty-three percent of the volume is in pyroclastic flow deposits, 38% in the lava dome, and 8% in ash-fall and pyroclastic surge deposits. Ejecta erupted in January include approximately 10% andesite scoria, 50% dacite pumices, and 40% hybrid and banded pumices. Results suggest that the basalt was moderately hydrous. Geothermometers (ol-spinel, px-px) indicate that the basalt was at 1100 to 1150°C, the dacite at 840 +- 30°C prior to mixing. The viscosity of the basalt was probably between 5 and 100 poises at 1100 to 1150°C, and the dacite 50,500 p. at 840°C, decreasing to 1000 p. at 1000°C. Hornblende in the basalt crystallized at roughly 75 to 25 km depth. The dacite resided in a shallow magma chamber between 10 km and 2 km deep, as indicated by the water content of the glass inclusions. (JGB)

GEOTHERMAL EXPLORATION AND EXPLORATION TECHNOLOGY

GEOPHYSICAL TECHNIQUES AND SURVEYS

48484 (ALO—3721-12) **Terrestrial heat flow studies in Arizona. Quarterly technical progress report, 1 November 1978—31 January 1979.** Shearer, C.R.; Reiter, M. (New Mexico Bureau of Mines and Mineral Resources, Socorro (USA)). Feb 1979. Contract EY-76-S-04-3721. 5p. Dep. NTIS, PC A02/MF A01.

Thermal conductivity measurements were made on lithologic samples from 12 temperature data sites. Two weeks were spent in Arizona in obtaining lithologic samples. Uranium analyses have been made for 12 locations in the Basin and Range and the Colorado Plateau.

48485 **Structure of the lower east rift zone of Kilauea volcano, Hawaii, from seismic and gravity data.** Broyles, M.L.; Suyenaga, W.; Furumoto, A.S. (Univ. of Hawaii, Honolulu). *J. Volcanol. Geotherm. Res.;* **5**: No. 3-4, 317-336(May 1979).

Two seismic refraction surveys were carried out in 1976 and 1977 on the east rift zone of Kilauea volcano as part of an exploratory program for geothermal resouces. The short traverse seismic refraction survey of January 1976 delineated the upper surface structure of the east rift, revealing velocities of 2.5 km/s under the Kalapana line and 3.1 km/s under the Leilani line beneath a surface layer of low, but variable velocity. This survey was not successful in determining the depth of the high-velocity material. The longer traverse seismic refraction survey of 1977 outlined a high-velocity body at a depth of 2.1 to 2.3 km. Crustal layer velocities of 3.0, 5.25 and 7.0 km/s were observed with kinks in the travel-time curves suggesting that the 7.0 km/s material is intruding into the 5.25 km/s zone. The high-velocity body was interpreted to be a complex of dikes containing solidified magma from past volcanic eruptions that provide energy for the hydrothermal processes associated with the rift zone. Analysis of gravity data from a survey of 1975 provided constraints on the horizontal extent of the dike complex indicating a width varying from 12 to 17 km. Density contrasts of 0.4 to 0.6 were obtained by using velocity—density systematics demonstrating that the extruded surface lava is quite different from that which remains at depth. One possible conclusion is that magma differentiation has taken place.

48486 **Geophysical studies in the High Plains of northeastern Colorado.** Chaipayungpun, W. Dallas, TX; Univ. of Texas (1977). 89p. University Microfilms Order No. 77-19,807.

Thesis (Ph. D.).

Magnetotelluric (MT) data were observed with a gain ranged digital field system at several sites in the High Plains of eastern Colorado. These sites were selected to be near a U.S. Geological Survey seismic refraction profile, yielding estimates for both resistivity and compressional velocity in the crust and upper mantle. The study area has unusually small lateral variation in electrical conductivity, leading to high quality MT apparent resistivity and phase data. Inferred resistivity distributions for the shallower layers are comparable to results derived from hearby well logs. It is possible that an anomalous crustal low resistivity zone at depths near 20 km can be related to low values of compressional velocity at similar depths, in consonance with similar results previously reported for west Texas and eastern New Mexico. The present MT data also suggest a relatively conducting region in the upper mantle, at depths near 120 km, which may correspond to the base of the lithosphere. Individual spot determinations of electrical conductivity and thus temperatures in the lower lithosphere for eastern Colorado are concordant with heat flow studies which show the geotherms rising westward toward the Rocky Mountain Front. The westward upwarp of the mantle geotherms in the eastern Colorado transition belt may be related to Laramide tectonism which produced a relatively shallow partial melt zone beneath the Rocky Mountains and other regions in western North America. Similar or even more marked upwarping of the geotherms can be seen to the south in New Mexico, where this transition belt merges with the Rio Grande Rift zone, located in an area of Quaternary and Recent volcanism.

GEOCHEMICAL TECHNIQUES AND SURVEYS

48487 **Compositions of gases collected during the 1977 east rift eruption, Kilauea, Hawaii.** Graeber, E.J.; Modreski, P.J.; Gerlach, T.M. (Sandia Labs., Albuquerque, NM). *J. Volcanol. Geotherm. Res.;* **5**: No. 3-4, 337-344(May 1979).

Several high-temperature (950 to 1060C°) gas samples were collected with a new sampling device from lava flows and a vent during the September 1977 Kilauea eruption. After removal of atmospheric contaminants (N_2, Ar, O_2), the gases are water-rich (90 to 95 mole %). This may be attributed to meteoric water or be indicative of relatively degassed, partially cooled magma that filled the rift zone. Numerous hydrocarbons in addition to CH_4 were present in a sample obtained in the presence of pyrolyzing vegetation.

48488 **Change with time of hot springs in Akita Prefecture.** Kitabayashi, T. (Akita Prefecture Institute of Public Health, Japan); Muto, R.; Katsumata, S.; Fujimori, Y. *Akita-ken Eisei Kagaku Kenkyushoho;* No. 21, 99-100(1977). (In Japanese).

In situ analysis of the saline Akita hot springs, located in the eastern part of Yatsuhashiyuda of Akita City, were carried out periodically at 1 pm on the 20th of each month. There was no significant difference in chemical components or temperature between results obtained in August 1958 and August 1976. Data obtained in 1976 indicated that precipitation was greatest in summer, the minimum occurred in January. The production of spring water was highest in winter, reaching a maximum in February and a minimum in September. Electrical conductivity increased as tne spring discharge rate increased, indicating an increase on the concentration of dissolved components. One figure, three tables, and three references are provided.

EXPLORATORY DRILLING AND WELL LOGGING

REFER ALSO TO CITATION(S) 48497

48489 (NP—23827) **Mahiao 1 evaluation report: geothermal exploration project.** (Kingston, Reynolds, Thom and Allardice Ltd., Auckland (New Zealand); PNOC Energy Development Corp., Metro Manila (Philippines)). May 1978. 65p. Dep. NTIS (US Sales Only), PC A04/MF A01.

Mahiao 1 was drilled to test the geothermal potential of the upper Mahiao valley. This follows a program of scientific investigation, and the drilling of twelve shallow temperaure gradient wells during the previous three years, in the area generally known as the Tongonan Geothermal Area. The well bottomed in an intrusive complex after penetrating 1600 m to 1700 m of the Bao Volcanic sequence. Downhole temperatures below 1490 m C.H.F. exceed 300°C with a maximum temperature at 1793 m C.H.F. of 324°C. The well became progressively blocked with fill thereby preventing further measurements being made below 1814 m C.H.F. The chemistry of the discharged fluids indicated a neutral pH, low bicarbonate, high chloride, highly mineralized (approx. 3% T.D.S.) water. Total gas content of the separated steam was 1.01% by volume of which CO_2 and H_2S constituted 99.55% by weight. The well is currently being used to provide steam to a 3 MW non-condensing turbine operated by the National Power Corporation.

ECONOMIC AND FINANCIAL ASPECTS

REFER ALSO TO CITATION(S) 48493

ENVIRONMENTAL ASPECTS AND WASTE DISPOSAL

REFER ALSO TO CITATION(S) 48480

48490 (LBL—8617) **Guidelines manual for surface monitoring of geothermal areas.** Van Til, C.J. (Woodward-Clyde Consultants, San Francisco, CA (USA)). May 1979. Contract W-7405-ENG-48. 132p. Dep. NTIS, PC A07/MF A01.

The following are covered: preliminary investigation, design of monitoring system, and monitoring operations. Included in appendices are: characteristics of geothermal subsidence, guidelines for specifications for monitoring subsidence, instruments for monitoring, formats for data presentation, and statistical analyses. (MHR)

48491 (UCRL—15026) **Analysis of the apiclutural industry in relation to geothermal development & agriculture in the Imperial Valley, Imperial County, California.** Atkins, E.L. (California Univ., Riverside (USA)). Apr 1979. Contract W-7405-ENG-48. 30p. Dep. NTIS, PC A03/MF A01.

PART I: Continuous exposure to 30 ppB H_2S increased lifespan of caged worker honey bees, Apis mellifera L., 33%; whereas, bees exposed > 13 days to 100 ppB and 300 ppB H_2S the lifespan was shortened 32% and 51%, respectively, over unexposed bees; bees exposed > 15 days to a combination of 300 ppB H_2S + 50 ppM CO_2 the lifespan was shortened 4.4% more that 300 ppB H_2S alone. The mean temperature and/or relative humidity did not exert a direct effect on the hazard to bees. A continuous exposure to 300 ppB SO_2 was detrimental to caged worker honey bees; and, a mean temperature of 27.2°C was 75.7% more toxic than the same dosage at 16.7°C. Worker bee lifespans exposed to 300 ppB SO_2 at 16.7°C were shortened 13.5% and 79%, respectively, compared to unexposed bees. Therefore, both dosage and temperature exert direct effects on the hazards to bees. PART II: The status of the apicultural industry in Imperial County, California, was outlined giving a short characterization of the area in relation to the apicultural industry. Agriculture utilizes 500,000 intensely farmed acres which generated a 11-year average income of $370 million. Over 40 agricultural commodities are produced. The apicultural industry is intimately involved in 25% of the total gross agricultural income. In addition, most of the flora growing in the desert community which comprises the remainder of the county are very important to honey bees by providing sustaining nectar and/or pollen for brood rearing. The bee foraged flora provides substantial bee forage when colonies are located outside of the agriculutral area. It is concluded that geothermal resource development in the Imperial Valley is contemplated to have minimal effects on the apicultural industry.

48492 (UCRL—81506) **Method of using in situ porosity measurements to place an upper bound on geothermal reservoir compaction.** Schatz, J.F.; Kasameyer, P.W.; Cheney, J.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Jan 1979. Contract W-7405-ENG-48. 6p. (CONF-7810170—3). Dep. NTIS, PC A02/MF A01.

From 2. international well-testing symposium; Berkeley, CA, USA (25 Oct 1978).

Placing an upper bound on reservoir compaction requires placing a lower bound on the reservoir effective compaction modulus. Porosity-depth data can be used to find that lower-bound modulus in a young sedimentary basin. Well-log and sample porosity data from a geothermal field in the Imperial Valley, CA, give a lower-bound modulus of 7.7 x 10^3 psi. This modulus is used with pressure drops calculated for a reservoir to determine an upper bound on reservoir compaction. The effects of partial reinjection and aquifer leakage on upper-bound subsidence estimated from the compaction are illustrated for a hypothetical reservoir and well array.

GEOTHERMAL POWER PLANTS

REFER ALSO TO CITATION(S) 48315

48493 (COO—4051-43) **Economics of geothermal power.** DiPippo, R. (Southeastern Massachusetts Univ., North Dartmouth (USA); Brown Univ., Providence, RI (USA)). Feb 1979. Contract EY-76-S-02-4051. 13p. Dep. NTIS, PC A02/MF A01.

Geothermal, steam, nuclear, and hydraulic construction costs, power generating costs, and utilization rate are compared. The risk factor in exploratory geothermal wells is discussed. (MHR)

48494 (UCRL—52576) **Water for long-term geothermal enegy production in the Imperial Valley.** Layton, D.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 22 Sep 1978. Contract W-7405-ENG-48. 51p. Dep. NTIS, PC A04/MF A01.

The geothermal resources of California's Imperial Valley have the potential for the production of an estimated 3000 to 5000 MW/yr of electricity for 30 yr, provided that adeuqate cooling water is available for power plants. There are five possible sources of cooling water: irrigation water, waste waters from agriculture, steam condensate, ground water, and water from the Salton Sea. Technical, environmental, and regulatory constraints, however, could limit the availability of the water supplies. Of particular concern are the constraints that could be imposed if different water policies were implemented. To study how future policies could affect geothermal development, six combinations of various policies were defined to represent potential regulatory controls. A range of future water balances in the valley was also specified. The water balances plus the six policy combinations were used to determine whether deficits of cooling water would eventually constrain low, medium, or high levels of geothermal energy production. A companion analysis of changes in the elevation and salinity of the Salton Sea resulting from the use of agricultural waters for cooling was also made.

DESIGN AND OPERATION

REFER ALSO TO CITATION(S) 48489

POWER PLANT SYSTEMS AND COMPONENTS

REFER ALSO TO CITATION(S) 48504

GEOTHERMAL ENGINEERING

DRILLING TECHNOLOGY AND WELL HARDWARE

48495 (NP—23800) **Malitbog 1 drilling report: geothermal exploration project.** (Kingston, Reynolds, Thom and Allardice Ltd., Auckland (New Zealand); PNOC Energy Development Corp., Metro Manila (Philippines)). Aug 1978. 27p. Dep. NTIS (US Sales Only), PC A03/MF A01.

MBI is the seventh of twenty projected geothermal exploration and development wells to be drilled by the New Zealand Ministry of Foreign Affairs IDECO H-525D rig. It is the first well drilled in the Malitbog Valley which outside the 10 ohm-meter contour of the Schlumberger resistivity anomaly. The drilling of the well to 1665.0 m and th initial well completion tests are reported. (MHR)

48496 (NP—23828) **Mahiao 2 drilling report: geothermal exploration project.** (Kingston, Reynolds, Thom and Allardice Ltd., Auckland (New Zealand); PNOC Energy Development Corp., Metro Manila (Philippines)). Apr 1978. 36p. Dep. NTIS (US Sales Only), PC A03/MF A01.

M2 is the second of twenty projected geothermal exploration and development wells to be drilled with the New Zealand ministry of foreign affairs IDECO H-525D Rig. The drilling of the well to 1901.9 m and the initial completion tests are reported. (MHR)

48497 (NP—23830) **Mahiao 3 drilling report: geothermal exploration project.** (Kingston, Reynolds, Thom and Allardice Ltd., Auckland (New Zealand); PNOC Energy Development Corp., Metro Manila (Philippines)). Aug 1978. 32p. Dep. NTIS (US Sales Only), PC A03/MF A01.

M3 is the fourth of twenty projected geothermal exploration and development wells to be drilled with the New Zealand Ministry of Foreign Affairs IDECO H-525D Rig. The drilling of the well to 1405.45 m and the initial completion tests performed prior to releasing the rig are reported. (MHR)

48498 (NP—23831) **Mahiao 4 drilling report: geothermal exploration project.** (Kingston, Reynolds, Thom and Allardice Ltd., Auckland (New Zealand); PNOC Energy Development Corp., Metro Manila (Philippines)). Jul 1978. 36p. Dep. NTIS (US Sales Only), PC A03/MF A01.

M4 is the third of twenty projected geothermal exploration and development wells to be drilled with the New Zealand Ministry of Foreign Affairs IDECO H-525D Rig. The drilling of the well to 1669.70 m and the initial completion tests performed prior to releasing the rig are reported. (MHR)

48499 (SAND—79-1398C) **Sandia/DOE geothermal drilling and completion technology development program.** Barnette, J.H. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 6p. (CONF-790906—1). Dep. NTIS, PC A02/MF A01.

From Geothermal Resources Council annual meeting; Reno, NV, USA (24 Sep 1979).

The high cost of drilling and completing geothermal wells is an impediment to the development of geothermal energy resources. Technological deficiencies in rotary drilling techniques are evidenced when drilling geothermal wells. The Division of Geothermal Energy (DGE) of the US Department of Energy (DOE) has initiated a program aimed at developing new drilling and completion techniques for geothermal wells. The goals of this program are to reduce well costs 25% by 1982 and 50% by 1986. Sandia Laboratories has managed this technology development program since October 1977, and this paper presents an overview of the program. A statement of program goals and structure is given. The content of the FY-79 program is presented and recent results of R and D projects are given. Plans for development of an advanced drilling and completion system are discussed.

CORROSION, SCALING, AND MATERIALS DEVELOPMENT

48500 (UCRL—52664) **Evaluation of materials exposed to scale-control/nozzle-exhaust experiments at the Salton Sea geothermal field.** Goldberg, A.; Kershaw, R.P. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Feb 1979. Contract W-7405-ENG-48. 46p. Dep. NTIS, PC A03/MF A01.

The erosion, corrosion, and stress corrosion cracking (SCC) of Ti-, Co-, Ni-, and Fe-base alloys specimens that were used in scale-control tests performed at the Salton Sea geothermal field were evaluated. Specimens were exposed to high-velocity, two-phase, 104°C nozzle exhaust that was produced by expanding acidified hypersaline, highly mineralized brine to atmospheric pressure through converging-diverging nozzles. The exposed specimens were evaluated using surface profilometer traces, light microscopy, scanning-electron microscopy, and energy dispersive spectroscopy ananlysis. The observed degradation was attributed largely to synergistic effects of erosion, corrosion, and stress. A principal mode of degradation appeared to be the formation and growth of corrosion-assisted erosion cavities; it was proposed that surface repassivation kinetics play a key role in the development of these cavities. It was also suggested that scale deposits on the metal surface may either alter the mode of attack or act as protective barriers. It was concluded that, of the potential turbine-blade materials tested, the Ti-base alloys exhibited the best combination of resistance to erosion, corrosion, and SCC.

48501 (UCRL—82814) **Silica control and materials tests at the Salton Sea geothermal field.** Quong, R.; Harrar, J.E.; McCright, R.D.; Locke, R.D.; Lorensen, L.E.; Tardiff, G.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Jun 1979. Contract W-7405-ENG-48. 9p. (CONF-790679—1). Dep. NTIS, PC A02/MF A01.

From 3. annual EPRI geothermal conference; Monterey, CA, USA (26 Jun 1979).

The Lawrence Livermore Laboratory maintains and operates a test facility near Niland, California, in the Imperial Valley for field studies on SSGF brine chemistry, scale and solids control, materials, and injection. Recent work in silica control and materials testing is reviewed.

GEOTHERMAL RESERVOIR AND WELL PERFORMANCE

48502 (UCRL—15034) **Analysis of a flow metering device for low-quality steam-water flows. Final report.** Crowe, C.T. (Washington State Univ., Pullman (USA). Dept. of Mechanical Engineering). 1976. Contract W-7405-ENG-48. 42p. Dep. NTIS, PC A03/MF A01.

The goal of this project is to investigate the potential of the meter configuration consisting of a sharp-edged contraction section followed by an extended length of constant area duct and finally a diffuser section for pressure recovery. This and two other configurations were tested. These configurations and the reasons underlying their selection are described and discussed. It is concluded that Murdock's correlation for steam/water flow through orifices and sudden contraction sections at low qualities is invalid and the metering scheme based on it is inoperative. (MHR)

48503 **Symmetric sink flow between parallel plates.** Murphy, H.D. (Los Alamos Scientific Lab., NM); Coxon, M.; McEligot, D.M. *J. Fluids Eng.;* **100**: No. 4, 477-484(Dec 1978).

From Winter annual meeting of the Fluids Engineering Division of the ASME; San Francisco, CA, USA (10 Dec 1978).

Steady, laminar, incompressible flow converging radially between two stationary disks is investigated numerically as a continuously developing flow problem under the internal boundary layer approximations. At dimensionless radii much greater than one the velocity profile becomes parabolic and invariant, but at radii less than one a typical external boundary layer evolves close to the wall with an approximately uniform core region; and the boundary layer thickness decreases from one-half the disk spacing to values proportional to the local radii as the flow accelerates. At large radii the friction factor approaches the classic value obtained for fully developed flow between infinite plates, but at small radii it approaches the constant $2.17/\sqrt{R_0}$, where R_0 is an overall Reynolds number based on the volumetric flow rate and the disk spacing and is independent of radius. Tabular and graphical results are provided for the intermediate range of radii, where both viscous and inertial effects are important and exact analyses are not available.

RESERVOIR STIMULATION AND EXTRACTION TECHNOLOGY

48504 (DOE/ET/28451—4) **Testing and modeling of downhole heat exchangers in shallow geothermal systems.** Culver, G.G.; Reistad, G.M. (Oregon Inst. of Tech., Klamath Falls (USA); Oregon State Univ., Corvallis (USA)). 1978. Contract EY-76-S-06-2429. 4p. (RLO—2429-4; CONF-780708—27). Dep. NTIS, PC A02/MF A01.

From Geothermal Resources Council meeting; Hilo, HI, USA (25 Jul 1978).

Results are reported of work on: characterizing flow in wells with perforated casings with and without downhole heat exchangers (DHE) installed, determining energy extraction rates for conventional DHES in both cased and uncased wells, and modeling of DHE systems to predict effects of heat exchangers and well variable changes.

DIRECT ENERGY UTILIZATION

REFER ALSO TO CITATION(S) 48315

48505 (BNL—26242) **Public data sources and modeling of district heating in the United States.** Karkheck, J.; Tessmer, R.G. Jr. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 4p. (CONF-790672—1). Dep. NTIS, PC A02/MF A01.

From International symposium on modeling, planning, and decision in energy systems; Montreux, Switzerland (19 Jun 1979).

A methodology for computerized modelling of hot water district heating service in any urban area in the United States is described. It is distinguished by the depth and breadth of its data bases, the ease with which any urban market can be analyzed and the wide variety of intermediate information which is obtained. Real housing and employment data, canvassed for the entire nation and made available on a very small area basis, are conjoined with local climate profiles, labor costs, land use intensity factors, fuel prices and fuel use profiles to generate profiles of heating demands and markets for district heat. This characterization of residential and commercial space and water heating demands permits a system design and costing of piping systems for distribution of hot water, subject to any penetration constraints imposed. A minimal number of assumptions are needed to generate these products from the data bases, many of which were generated in the public domain for other purposes.

GEOTHERMAL DATA AND THEORY

REFER ALSO TO CITATION(S) 49288

48506 Were Archean continental geothermal gradients much steeper than those of today. Burke, K.; Kidd, W.S.F. (State Univ. of New York, Albany). *Nature (London);* **272**: 240-241(16 Mar 1978).

Studies indicate that the rocks of the Superior Province (formed roughly in the interval 3,100 to 2,500 My ago) were not subjected to steep regional geothermal gradients after their assembly into a continent by lateral accretion of island arcs, and hence that the extra Archean heat escaped the Earth in some way other than by conduction through the continent. It is suggested that this escape was mainly by cooling of the ocean floor as a boundary conduction layer.

PROPERTIES OF AQUEOUS SOLUTIONS

REFER ALSO TO CITATION(S) 48968

PROPERTIES OF MINERALS AND ROCKS

48507 Melting of plagioclase in the system sodium oxide—calcium oxide—aluminum oxide—silicon oxide—water at high pressure and temperature. Furst, G.A. University Park, PA; Pennsylvania State Univ. (1978). vp. University Microfilms Order No. 78-12,046. Thesis (Ph. D.).

The melting of plagioclase ($NaAlSi_3O_8$— $CaAl_2Si_2O_8$) in the presence of a water rich vapor was investigated between 8 and 20 kbar. The familiar one atmosphere melting loop is preserved at 8 and 10 kbar. The vapor saturated solidi at 8 and 10 kbar are depressed at 485°C and 550°C, respectively, relative to the melting of plagioclase at one atmosphere pressure. At 10 kbar, plagioclase of An_{50} bulk composition begins to melt at 730°C and does not coexist with a liquid above 1020°C. At 12 kbar plagioclase of An_{50} bulk composition begins to melt at 690°C, and the melting interval is only 30°C wide. The solidus at 16 kbar for An_{50} starting composition occurs at 670°C. The upper stability of plagioclase in this bulk composition if 730°C, with a melting interval of 60°C. Kyanite is stable above the plagioclase melting interval for intermediate plagioclase starting compositions in the assemblage zoisite + kyanite + liquid + vapor. At 18 kbar kyanite occurs above the plagioclase liquidus. Jadeite coexists with an anorthite-rich plagioclase above the solidus in the narrow composition range of An_{10} to An_{30}. Plagioclase is not found in runs at higher temperatures. High fugacity of water in the study makes direct applications to natural systems difficult, but this study illustrates the maximum pressure and temperature stability of plagioclase in the presence of H_2O vapor. The local layers of low seismic velocity within the earth's crust are not due to incipient melting of plagioclase. Intersection of the hydrous plagioclase solidus with the proposed crystal geotherm would occur at depths that are greater than the determined thickness of the earth's crust. (JGB)

ROCK-WATER-GAS INTERACTIONS

48508 Model for uranium and thorium assimilation by intrusive magmas and crystallizing plutons through interaction with crustal fluids. Gosnold, W.D. Jr. Dallas, TX; Southern Methodist Univ. (1976). 143p. University Microfilms Order No. 77-18,603. Thesis (Ph. D.).

Evidence for interaction between intrusives and meteoric ground water synthesized with information on the occurrence and distribution of uranium and thorium in the continental crust suggests that intrusive magmas may mobilize and assimilate uranium and thorium through interaction with crustal fluids. Investigations of the distribution of uranium, thorium, and potassium within and around eight epizonal plutons show mobilization and redistribution of uranium and thorium in the contact aureoles of plutons which have interacted with meteoric ground water. In these plutons uranium is shown by induced fission track radiography to be associated with both primary and secondary hydrous minerals and with secondary opaque minerals. Plutons which have not interacted with meteoric ground water show little association between uranium and hydrous or opaque minerals. Studies of epizonal, mesozonal, and catazonal plutons in the Idaho batholith show that the highly radioactive epizonal plutons contain much uranium in hydrous and secondary minerals whereas the low radioactivity mesozonal and catazonal plutons do not. The apparent exponential vertical distribution of radiogenic heat production in plutonic rocks can be explained by an assimilation model in which the degree of assimilation increases toward the surface as a result of increasing accessibility of crustal fluids, particularly meteoric ground water.

TIDAL POWER

REFER ALSO TO CITATION(S) 48750

WAVE ENERGY CONVERTERS

REFER ALSO TO CITATION(S) 48750

WIND ENERGY

REFER ALSO TO CITATION(S) 48750

REGULATIONS

REFER ALSO TO CITATION(S) 48267, 48269

ECONOMICS

REFER ALSO TO CITATION(S) 48512

48509 (DOE/NASA/1028—79/23) **Wind turbines for electric utilities: development status and economics.** Ramler, J.R.; Donovan, R.M. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1979. Contract EX-76-A-29-1028. 22p. (NASA-TM—79170; CONF-790611—4). Dep. NTIS, PC A02/MF A01.

From AIAA terrestrial energy systems conference; Orlando, FL, USA (4 Jun 1979).

The technology and economics of the large, horizontal-axis wind turbines currently in the Federal Wind Energy Program are presented. Wind turbine technology advancements made in the last several years are discussed. It is shown that, based on current projections of the costs of these machines when produced in quantity, they should be attractive for utility application. The cost of electricity (COE) produced at the busbar is shown to be a strong function of the mean wind speed at the installation site. The break-even COE as a fuel saver is discussed and the COE range that would be generally attractive to utilities is indicated.

WIND ENERGY ENGINEERING

APPLICATIONS

REFER ALSO TO CITATION(S) 48731

TURBINE DESIGN AND OPERATION

48510 (BMFT-FBT—79-04) **Development of a 5,5 m diameter vertical axis wind turbine (Phase II).** Binder, G.; Fritzsche, A.; Vollan, A.; Dekitsch, A.; Joos, R.; Welte, D.; Etzler, C.C.; Schmelzle, J. (Dornier-System G.m.b.H., Friedrichshafen (Germany, F.R.)). Jun 1978. 142p. (In German). Dep. NTIS (US Sales Only), PC A07/MF A01.

In continuation of the preceding project, Development of a Vertical-Axis Wind Turbine (Phase I), the design work was performed including the aerodynamic and structural dynamic investigations. The wind energy converter has been built and tested in a wind tunnel. The rotor diameter of 5.5 m is not only a suitable size for the aerodynamic tests, but guarantees also that the results of subsequent field tests will contribute to the experimental data required for the design of larger converters. The layout of the rotor, the construction methods and the choice of materials promise favourable economic conditions for a series production applying advanced mass production technology, without excluding the manufacture in developing countries. The wind tunnel tests, performed with the 2-, 3- and 4-blade version of the Darrieus-rotor and with Savonius-rotors of different heights confirmed experimentally the aerodynamic calculations and provided further know-how referring to influences not accessible to calculation.

48511 Optimization of wind energy conversion systems. Smith, M.C. (Mich State Univ, East Lansing). *Policy Anal. Inf. Syst.;* **2**: No. 1, 149-171(15 Jul 1978).

Technical optimization of wind energy conversion systems, including site selection, is described and an example given. It is shown that only system efficiency, wind charactertistics, energy desired, and the system cost structure are required. Electric grid energy usage with no storage is assumed.

48512 (SERI/TP—35-263) **Giromill overview.** McConnell, R.D. (Solar Energy Research Inst., Golden, CO (USA)). 1979. Contract EG-77-C-01-4042. 14p. (CONF-790501—1). Dep. NTIS, PC A02/MF A01.

From Wind energy innovative systems conference; Colorado Springs, CO, USA (23 May 1979).

The Giromill is a vertical axis wind turbine having straight airfoils whose angles of attack are controlled so as to maximize wind energy conversion. Each airfoil is rocked during a revolution in order to maintain a constant positive angle of attack over one half revolution and a constant negative value over the other half revolution. McDonnell Aircraft Company completed a feasibility study of the Giromill in 1976. Their initial work was followed by model tests in a wind tunnel in 1976 and 1977. Presently the Pump Division of Valley Industries, Inc., is cooperating with McDonnell Aircraft to design, build, and deliver a 40-kW (8.9-m/s) Giromill for the US Department of Energy. Delivery to Rocky Flats is scheduled for the end of 1979. In addition to describing the above work, an evaluation of the Giromill concept in terms of some wind energy rules-of-thumb is presented.

ELECTRIC POWER ENGINEERING

REFER ALSO TO CITATION(S) 48749

48513 (DOE/ET—0106) **3rd annual program information notice.** (Department of Energy, Washington, DC (USA). Div. of Electric Energy Systems). Jul 1979. 105p. Dep. NTIS, PC A06/MF A01.

The Division of Electric Energy Systems (EES), prepares and disseminates this program information notice on a periodic basis to inform interested organizations and individuals of the Division's progress in research and development specifically concerned with the Nation's electric energy system. The broad overall objective of the EES Program is to help ensure that the Nation's electric energy system is capable of meeting future demands reliably, with the lowest practicable energy losses, with maximum energy conservation, and in accordance with environmental and National Energy Policy (NEP) principles and policies. To this end, the EES Program focuses on RD & D designed to produce benefits in support of the national energy priorities of improvement in the efficiency of the electrical energy system (increased capacity utilization, decreased capital requirements, increased reliability, etc.); fuel shifting from oil and gas to more abundant nonrenewable resources in the near term and to renewable resources in the long-term; energy conservation; and environmental enhancement. The current EES Program consists of two major technical areas, Power Delivery and Power Supply Integration. Research activities in these two areas are listed with each entry containing the name of the study, contract number, contractor name and address, and purpose of each contract. (LCL)

POWER PLANTS AND POWER GENERATION

REFER ALSO TO CITATION(S) 48315

48514 (KFK-CAD—118) **Planning, design, and supervision of electrical engineering.** Bethmann, J.; Klein, D.; Koldau, S.; Lottmann, K.; Mehring, P.; Rothenberg, R.; Wilke, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekttraegerschaft Rechnerunterstuetztes Entwickeln, Konstruieren und Fertigen). Mar 1979. 199p. (In German). Dep. NTIS (US Sales Only), PC A09/MF A01.

From Seminar held at the Haus der Technik; Essen, Germany, F.R. (8 Mar 1979).

These proceedings contain the six papers presented at the seminar on CAD/CAM (Computer-aided design/computer-aided manufacturing) in the planning, design, and development of electrical installations. The aim of the meeting was to present information on development and design in electrical engineering. The possibilities of some data processing programs are presented and their practical applications are demonstrated. The topics discussed are: the CAD/CAM research program, support of engineering developments in the planning and construction of electrical installations, simulation of power electronic installations with the NETASIM digital simulation systems, selection of motors, cables, and switches using the PEKA program, manufacturing control for control electronics, and CAD/CAM development of electrical installations for energy production, distribution, and use. (JSR)

COOLING AND HEAT TRANSFER EQUIPMENT AND SYSTEMS

REFER ALSO TO CITATION(S) 48545

48515 (BNL—50887) **Documentation of an interactive program for projecting space heating energy demand (IPPSHED).** Schneider, D. (Brookhaven National Lab., Upton, NY (USA)). Aug 1978. Contract EY-76-C-02-0016. 142p. Dep. NTIS, PC A07/MF A01.

The model presented here is designed to be a tool for analyzing the effects of conservation strategies in reducing building energy demands. The purpose of the model is to project residential space heating demands for defined structural types. The user obtains energy demand projections, interactively, for different geographic regions. These energy demands are derived by incorporating theoretical building energy loads, projected housing and fuel mixes, and the efficiencies of both the structures and the conversion devices. The User's Guide in Appendix A contains the necessary information for running the model. This section will be published as a separate report.

48516 (COO—4218-2) **Conceptual designs and cost estimates of mechanical draft wet/dry and natural draft dry cooling systems using Curtiss-Wright integral fin-tube heat exchangers.** Haberski, R.J.; Bentz, J.C. (Curtiss-Wright Corp., Wood-Ridge, NJ (USA). Nuclear Div.). Apr 1979. Contract EN-77-C-02-4218. 107p. (CW-WR—79-010). Dep. NTIS, PC A06/MF A01.

This study was performed to establish a conceptual design and cost evaluation of an advanced technology mechanical draft wet/dry and natural draft dry cooling systems for large electric power plants using a high performance integral fin-tube heat transfer surface. This study was part of an overall DOE program to develop and demonstrate advanced concept cooling systems for large electric power plants. The results obtained show significant economic advantages compared to results previously published for conventional cooling systems. These advantages are due to the higher heat transfer and lower pressure loss which occur with the use of the selected multi-port integral fin-tubes.

48517 **Steam raising unit with flat combustion chamber floor supported on a supporting grate frame.** Brueckner, H.; Kral, R. (to Kraftwerk Union A.G., Muelheim an der Ruhr (Germany, F.R.); Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,153,223/C/. 13 Jul 1978. 5p. (In German).

This patent is concerned with evening out the,, very different thermal expansion of the side wall tubing and the combustion chamber floor tubing supported directly on the boiler frame by the supporting grate frame. Simultaneously with this, the present difference in height in an edge zone is evened out by the path of the outer floor pipes according to the invention. This prevents bulging of the edge zone. The floor tubing transmits the greater part of its weight by many support points to a supporting grate frame below, made of beams crossing at right angles. To compensate for differential expansion, the outer ends of the beams are sprung and supported so as to be movable in a support frame hung on the boiler frame, which surrounds the side tube walls. In the edge zones of the supporting grate frame and the combustion chamber floor, short stiffening beams are inserted in the beams between the sprung bearing. They are hung from the tubewalls on the outside and their inner end is supported on the outermost crossbeam crossing them. In the center of this stiffening beam there are support points for the floor tubes of the edge zone. These are taken to the level of the lower side wall tubes, while the floor tubes of the inner zone can be set on their supporting grate frame independent of the momentary height of the side tubing.

48518 **Draining device in a steam raising unit.** Cassell, D.S. (to Combustion Engineering, Inc., Windsor, CT (USA); Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,532,200/C/. 2 Feb 1978. 5p. (In German).

In order to be able to drain off the deposits of solid particles behind the tube plate of steam raising units, a draining chamber with an outlet into the drop space of a steam raising unit is installed. By choosing suitable flow guide sheets, the deflection of flow prevents deposition of solids.

POWER CYCLES

48519 (COO—2764-T3) **Free-Piston Stirling Engine demonstrator test plan.** (Mechanical Technology, Inc., Latham, NY (USA)). 15 Dec 1978. Contract EY-76-C-02-2764. 52p. Dep. NTIS, PC A04/MF A01.

Mechanical Technology Incorporated is developing a 1 KWe Free-Piston Stirling ENgine (FPSE) Power System. The plan for testing the demonstrator power system is presented. The test hardware is a Free-Piston Stirling Engine prime mover driving a linear alternator. The demonstrator system is basically a modular assembly. The modules are the reciprocating alternator section, engine section, heater head insulation package assembly, and the pressure vessel. The test objective is to demonstrate a system with greater than 30% overall efficiency at 1 KW, 45 hz operating conditions, and to identify and isolate engine losses to provide a basis for future engine improvements.

48520 (FE—2357-22) **CFCC development program. Quarterly report, October—December 1977.** (General Electric Co., Schenec-

tady, NY (USA). Energy Systems Programs Dept.). May 1978. Contract EX-76-C-01-2357. 84p. Dep. NTIS, PC A05/MF A01.

Progress is reported in a research program whose objective is to evaluate the coal-fired combined cycle (CFCC) power plant conceptual design, of the pressurized fluidized-bed type, with power recovery gas turbine and to conduct a supporting development program. The supporting development is required for evaluating the pressurized fluidized-bed combustion concept, for developing engineering correlations to be used in optimizing the commercial plant concept, and for evaluating the combustor/steam generator, the hot-gas cleanup, and the advanced gas turbine materials approach for this application. The results of this program will provide a backup concept and program for commercialization of pressurized fluidized-bed combustion. During this reporting period the following results were obtained: evaluation of test results proceeded; particle size distribution down to 1μ was developed based upon measured data. Included in this evaluation was a study of different techniques for particle sizing. Chemical analysis of captured particles was evaluated as a function of particle size, leading to the conclusion that the ash tends to segregate in the small size end of the distribution while the spent and unspent sorbent tends to concentrate in the larger sizes. Trace element analysis, including lead, arsenic, selenium, beryllium, mercury antimony and cadmium were completed for the CFCC design. In all cases, the ground level concentrations were significantly below prevailing standards. Alternate combustor-steam generator configurations were considered. Based upon accumulated exposure of 2800 hr in two burner rig simulations, candidate material protection systems were selected for exposure during future tests. The other actual PFB exposure program has completed its 100 hr shakedown testing.

48521 (FE—2357-25) **CFCC development program. Quarterly report, January—March 1978.** (General Electric Co., Schenectady, NY (USA). Energy Systems Programs Dept.). Jul 1978. Contract EX-76-C-01-2357. 44p. Dep. NTIS, PC A03/MF A01.

Progress is reported in the development of a coal-fired combined cycle power plant which uses steam produced in tubes within the fluidized-bed combustor to drive the steam turbine and combustion gases from the pressurized fluidized-bed combustor to drive the gas turbine. The reference plant configuration for the Design Review has been defined. Specifically, a configuration that represents current development hardware has been specified. Continuing combustor-steam generator configuration studies have included evaluation of refractory lined pressure vessels and horizontal pressure vessel, water wall lined. In the latter, a combined bed configuration appears to provide substantial advantages. The test of shrouded hot gas ducting at the size and temperature of the CFCC configuration was initiated. Initial results are favorable. Small burner rig simulation testing continues with several materials consistently showing strong performance. Process evaluation to verify that new materials can be applied to turbine buckets, is proceeding. Materials performance data on clad specimens is being evaluated and indicates reasonable success in this area. Testing of the developmental cyclone is progressing at a slower pace than anticipated due to test setup difficulties which are being overcome. The Aerodyne cyclone, diagnostic probes, electrostatic charger and materials test section have been shipped to CURL at Leatherhead, England. CURL has essentially completed engineering design of the facility modification and actual implementation of the modifications will now take place. (LCL)

48522 (FE—2357-28) **CFCC development program. Commercial plant design definition (Task 1.2).** (General Electric Co., Schenectady, NY (USA). Energy Systems Programs Dept.). Mar 1978. Contract EX-76-C-01-2357. 147p. Dep. NTIS, PC A07/MF A01.

Progress is reported in a research program whose objective is to evaluate the coal fired combined cycle (CFCC) powerplant conceptual design, of the pressurized fluidized bed type, with power recovery gas turbine and to conduct a supporting development program. The supporting development is required for evaluating the pressurized fluidized bed combustion concept, for developing engineering correlations to be used in optimizing the commercial plant concept, and for evaluating the combustor/steam generator, the hot-gas cleanup, and the advanced gas turbine materials approach for this application. The results of this program will provide a backup concept and program for commercialization of pressurized fluidized bed combustion. This report summarizes the CFCC commercial power plant and major component conceptual design activities of the overall program preparatory to the planned design review. The purpose of this activity was to establish a reference configuration for evaluation through trade-off studies conducted parallel with the design effort. A second more detailed plant design definition and costing phase is planned following the design review, based upon a reference plant design either confirmed or modified by the trade-off studies. Critical plant technology areas are also being pursued as part of the overall program in parallel with the design and trade-off tasks, including gas turbine materials, hot gas cleanup and pressurized fluidized bed boiler (PFBB) technology. Certain of the test programs, especially long-term materials testing, are not scheduled to be finished prior to completion of the plant design activities; thus, further plant design updates based upon completion of technology tests can be expected. Certain critical design assumptions, specifically gas turbine materials life with respect to hot corrosion, cannot be verified until the long-term test results are available and are subject to change based upon test results. (LCL)

48523 (FE—2357-34) **CFCC development program. Preliminary turbine materials evaluation for commercial plant (Task 3).** (General Electric Co., Schenectady, NY (USA). Energy Systems Programs Dept.). Mar 1978. Contract EX-76-C-01-2357. 62p. Dep. NTIS, PC A04/MF A01.

Progress is reported in a research program whose objective is to evaluate the coal fired combined cycle (CFCC) powerplant conceptual design, of the pressurized fluidized bed type, with power recovery gas turbine and to conduct a supporting development program. The supporting development is required for evaluating the pressurized fluidized bed combustion concept, for developing engineering correlations to be used in optimizing the commercial plant concept, and for evaluating the combustor/steam generator, the hot-gas cleanup, and the advanced gas turbine materials approach for this application. The results of this program will provide a backup concept and program for commercialization of pressurized fluidized bed combustion. During this reporting period cladding materials for gas turbine components were tested for corrosion and strength characteristics. These tests and their results are described. (LCL)

48524 (FE—2357-36) **CFCC development program. Hot gas clean-up efflux characterization for commercial plant (Task 4.1.1).** (General Electric Co., Schenectady, NY (USA). Energy Systems Programs Dept.). Mar 1978. Contract EX-76-C-01-2357. 56p. Dep. NTIS, PC A04/MF A01.

Progress is reported in a research program whose objective is to evaluate the coal-fired combined cycle (CFCC) power plant conceptual design, of the pressurized fluidized-bed type, with power recovery gas turbine and to conduct a supporting development program. The supporting development is required for evaluating the pressurized fluidized-bed combustion concept, for developing engineering correlations to be used in optimizing the commercial plant concept, and for evaluating the combustor/steam generator, the hot-gas cleanup, and the advanced gas turbine materials approach for this application. The results of this program will provide a backup concept and program for commercialization of pressurized fluidized-bed combustion. During this reporting period results were obtained for the chemical and physical properties of combustion products from the fluidized-bed combustor, and the flow rate and size distribution of particles in the combustor effluent. (LCL)

48525 (FE—2357-37) **CFCC development program. Performance guidelines for commercial plant (Task 4.1.2).** (General Electric Co., Schenectady, NY (USA). Energy Systems Programs Dept.). Mar 1978. Contract EX-76-C-01-2357. 45p. Dep. NTIS, PC A03/MF A01.

Progress is reported in a research program whose objective is to evaluate the coal-fired combined cycle (CFCC) power plant conceptual design, of the pressurized fluidized-bed type, with power recovery gas turbine and to conduct a supporting development program. The supporting development is required for evaluating the pressurized fluidized-bed combustion concept, for developing engineering correlations to be used in optimizing the commercial plant concept, and for evaluating the combustor/steam generator, the hot-gas cleanup, and the advanced gas turbine materials approach for this application. The results of this program will provide a backup concept and program for commercialization of pressurized fluidized-bed combustion. During this reporting period the characteristics of hot gases from the fluidized-bed combustor, the effects of these combustion products on turbine corrosion and erosion, and the performance requirements for hot-gas cleanup equipment were studied. (LCL)

48526 **Stirling engine.** Facey, J. (Dept. of Energy, Washington, DC). *Public Power;* **36**: No. 2, 42(Mar 1978).

One of the features of Stirling engines creating interest in their use for power generation is their ability to run on low-grade energy sources. The operation and applications of Stirling engines are briefly discussed, and several research programs involving Stirling engines are described. (PMA)

48527 **Thermal testing of the GT-35 gas turbine plant in the steam turbine—gas turbine plant with a high-head steam generator.** Ol'khovskii, G.G.; Povolotskii, L.B.; Kaplan, M.P.; Bumarskov, A.O.; Belov, A.I.; Chernomordik, L.I.; Korzh, P.I. *Teploenergetika (Moscow);* **23**: No. 12, 51-55(1976).

The gas turbine section of the PGU-200 steam turbine—gas turbine plant was tested at Nevinnomysk power station at loads up to 35 MW. The parameters of the gas turbine plant at maximum loads were: flowrate of air through compressor 220 to 240 kg/s, outlet compressor pressure 0.67 to 0.72 MPa, mean inlet turbine gas temperature 700 to 735°C. These parameters correspond to the

design ones and ensure the required conditions of operation of the high-head steam generator in the ST—GT plant as a whole. The performance characteristics of the main elements of the gas turbine plant were found to be at the design level: compressor efficiency 86 to 87%; turbine efficiency 87 to 88%; capacity of turbine anti G/sub T/ = 1.00 to 1.01. The output of the compressor was about 5% above design.

COMPONENTS

REFER ALSO TO CITATION(S) 48520, 48521, 48522, 48523, 48524, 48525

48528 (CONF-790808—14) **Heat transfer and pressure drop in gas-cooled fluidized-bed combustors for gas turbine systems: analysis and application to design.** Graves, R.L. (Oak Ridge Y-12 Plant, TN (USA); Department of Energy, Washington, DC (USA). Office of Fossil Energy). 1979. Contract W-7405-ENG-26. 21p. Dep. NTIS, PC A02/MF A01.

From 18. ASME national heat transfer conference; San Diego, CA, USA (Aug 1979).

Information is presented concerning the effects of design parameters for fluidized bed air heaters for gas turbines on the cost-related characteristics of the inbed heat exchanger. An analysis of the pressure drop/heat transfer relations is described and the results and implications for design are presented. According to these results, the cost of the heater for a pressurized, closed-cycle turbine system is likely to exceed that of an open-cycle system in which the compressor discharge pressure is lower. Higher air pressure and higher allowable pressure drop are shown to be effective in lowering the operating temperature of the heat exchanger tubes.

48529 **Coal-burning diesel.** Moore, W. (Dept. of Energy, Washington, DC). *Public Power;* **36**: No. 2, 52(Mar 1978).

The present energy situation has rekindled interest in the decades-old idea of utilizing coal as a fuel for diesel engines. Today, the odds against developing a successful coal-burning diesel are much shorter, and reasons for this situation are discussed. Today's large bore, slow speed diesels, with characteristics of high efficiency, minimum cooling water requirements, competitive cost, short construction time and potential for operation on coal and coal-based fuel, appear very attractive for fulfilling power requirements for the small to medium sized utility sector and industrial cogeneration.

48530 **Externally-fired gas turbine.** Facey, J. (Dept. of Energy, Washington, DC). *Public Power;* **36**: No. 2, 54(Mar 1978).

Development and demonstration of the technology for externally-fired gas turbines operating either as indirectly-fired open or closed cycles are the objectives of a project of the Department of Energy's Division of Power Systems. Major emphasis is on stationary prime movers of up to 20 MW in sizes for dispersed power generation applications. A major goal of the externally fired Brayton project is to develop a reliable gas turbine that can be used with a variety of heat sources other than high grade petroleum or natural gas fuels.

48531 **Directly-fired gas turbine.** Fairbanks, J. (Dept. of Energy, Washington, DC). *Public Power;* **36**: No. 2, 56(Mar 1978).

A project of the Department of Energy's Division of Power Systems seeks to develop and demonstrate the technology of a reliable advanced liquid fuel gas turbine for industrial cogeneration and utility applications in the early 1980s. The project will focus on the development of gas turbine combustors for environmentally acceptable operation burning heavy petroleum and liquid coal-derived fuels with high concentrations of fuel-bound nitrogen.

WASTE HEAT UTILIZATION

48532 **Organic Rankine cycle.** Gunn, M.E. Jr. (Dept. of Energy, Washington, DC). *Public Power;* **36**: No. 2, 44, 51(Mar 1978).

Organic Rankine cycle systems are currently being developed for waste heat recovery systems from thermal power plants and industrial plants. DOE is supporting the development of three unique concepts of packaged Rankine cycle systems using different working fluids ranging from steam to Freon. The systems will recover the waste heat from the prime mover exhaust streams and convert it to additional useful shaft power at efficiency levels of 18 to 20%.

ECONOMICS

REFER ALSO TO CITATION(S) 48785

OFF-PEAK ENERGY STORAGE

REFER ALSO TO CITATION(S) 48724, 48752

FUELS

REFER ALSO TO CITATION(S) 48094

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 48073, 49135, 49147

48533 (DOE/TIC—10136) **Analysis of the validity of the utilities stock-recruitment curve-fitting exercise.** Christensen, S.W.; Goodyear, C.P.; Kirk, B.L. (Oak Ridge National Lab., TN (USA); Fish and Wildlife Service, Ann Arbor, MI (USA)). May 1979. Contract W-7405-ENG-26. 316p. Dep. NTIS, PC A14/MF A01.

An analysis was made of the validity of the stock-recruitment curve-fitting exercise used to quantify the consequences of power plant operation on the striped bass population of the Hudson River. The use of a particular stock-recruitment model, called the Ricker model (Ricker 1954, 1958, and 1974), forms a cornerstone of the utilities' case. Based on estimates of a parameter termed "alpha" in the Ricker model, estimates of annual entrainment and impingement impacts of the Hudson River power plants on young-of-the-year striped bass are converted to estimates of long-term reduction in the equilibrium population size of adult striped bass. Results of the analysis of the exercise indicate that it is not valid.

48534 **Power plant cumulative environmental impact report.** Annapolis, MD; Maryland Department of Natural Resources (1978). 326p. (PPSP-CEIR—2).

Separate abstracts were prepared for the six sections of the report. An appendix is included on the ten-year plan of Maryland electric utilities, possible and proposed power plants, 1978 to 1987. Another appendix is included on electricity consumption in Maryland for the next ten years. (HLW)

48535 **Energy and electric power.** pp I.1-I.74 of Power plant cumulative environmental impact report. Annapolis, MD; Maryland Department of Natural Resources (1978).

The total time required for the construction of large-scale electric generating plants ranges up to 8 to 10 years for coal plants and up to 15 years for nuclear plants. Utilities plan for new capacity requirements ten or more years in advance. Maryland utility systems plan to add 3,024 megawatts of generating capacity by 1987 within Maryland. An additional 4,245 megawatts of capacity within Maryland is tentatively projected for the period 1987 to 1997. The projected increase in load factors will result in the addition of relatively more baseload capacity by these systems. Comparison of capacity from existing and proposed plants with demand projections for the utility systems serving Maryland indicate that adequate electric power will be available over the next ten years. Based on Power Plant Siting Program demand projections and completion of planned generation additions, utility capacity plans will result in reserve margins above 25% for most of the period, with reserve margins reaching 30% by 1980, and dropping to the 25 to 27% range for the remainder of the period. As a result of reported financial and licensing difficulties, the Allegheny Power System (which includes Potomac Edison) may be unable to construct two generating stations planned to come online in the years 1983—1987. Based on the utility's demand projections, this contingency could cause available capacity over those years to fall as low as 10.9% below peak demand.

48536 **Other impacts.** pp VI.1-VI.29 of Power plant cumulative environmental impact report. Annapolis, MD; Maryland Department of Natural Resources (1978).

Cooling towers can be an environmentally-acceptable alternative to once-through cooling. Basically, a cooling tower exchanges consumptive water use and possible terrestrial effects for effects in the aquatic environment. There also is a loss in energy production. Because the balance of these effects is site-specific, each plant location should be examined to determine the appropriate cooling system. Studies at Chalk Point indicate that salt deposition from the natural draft cooling tower would not exceed 8 kg/ha/month (7 lb/acre/month) at the maximum point. Experiments to determine the sensitivity of corn, soybeans, or tobacco indicated that no significant effects occurred at deposition rates below 20 kg/ha/month (18 lb/acre/month). The routing of transmission lines deals with effects that may have aesthetic, ecological, health and physical implications. The aesthetic effects generally include trade-offs between visibility and environmental protection. Ecological effects can be both positive and negative and must be evaluated on a case-by-case basis. The electrical effects are now well understood and are potentially significant only for locations within, or extremely close to the right of way. The health effects remain an area of controversy, mainly due to differing medical results from U.S. and Soviet studies.

THERMAL EFFLUENTS

REFER ALSO TO CITATION(S) 49273

NOXIOUS GAS AND PARTICULATE ABATEMENT AND CONTROL

REFER ALSO TO CITATION(S) 48069, 49114, 49129, 49130

48537 (FE—2295-32-5) **Medium and high temperature gas clean-up of particulates. Quarterly progress report, October—December 1978.** (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Mar 1979. Contract EX-76-C-01-2295-032. 9p. Dep. NTIS, PC A02/MF A01.

The diffusion charger has been tested to temperatures where it ceases to charge particulate sufficiently for good collection efficiency.

48538 (UCRL—82761) **Physical and chemical characterization of aerosol emissions from coal-fired power plants.** Ondov, J.M.; Biermann, A.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Jun 1979. Contract W-7405-ENG-48. 16p. (CONF-790458—3). Dep. NTIS, PC A02/MF A01.

From Symposium on environmental and climatic impact of coal utilization; Williamsburg, VA, USA (17 Apr 1979).

Conventional power plants, fired by pulverized coal, are the largest single anthropogenic source of atmospheric fine particles and sulfur oxides and the second largest source of nitrogen oxides. Associated with the atmospheric emission of fine particulate matter and oxides of sulfur and nitrogen is the concurrent release of potentially toxic trace elements and heavy metals, naturally occuring radionuclides, and potentially carcinogenic organic and inorganic compounds. We have examined physical and chemical properties of particulate emissions from eight different boilers all burning pulverized coal and equipped with either hot or cold-side electrostatic precipitators or venturi wet scrubbers. The results of these studies, including classification of morphology, measurement of distribution parameters of aerosol particles, and comprehensive analyses of fly-ash particles for trace elements, heavy metals and radionuclides are discussed. However they are formed, these particles serve as surfaces for the condensation or adsoprtion of substances volatilized during combustion. Davison et al. demonstrated an inverse size dependence of the concentration of many elements in coal fly ash. This is indeed the behavior one would expect if some portion of the element resided in a relatively thin surface layer that was deposited from the gas phase.

POWER TRANSMISSION AND DISTRIBUTION

48539 (AD-A—061029) **Digital computer, interactive graphics control of an electrical power system. Master's thesis.** Davis, L.R. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1978. 134p. NTIS PC A07/MF A01.

This thesis presents the details of the design for the digital computer control of an electric power system. The input-output medium is the innovative, interactive graphics terminal. The combination enables a man-machine interface with interaction at a level not achieveable in earlier control systems. The system easily solves the problem of scale encountered with the large power system by storing representations of the system on disk and recalling them as needed. The displays also present the system variables from remote points to enable better monitoring and control. The collection of displays described in this thesis make possible a powerful and unique research and educational facility. Experimental research on digital control of an electric power system is prohibitive on a real power system. Educationally, it provides the student state-of-the art training in control of electric power systems. The information provided is applicable to the design of any digital control system using interactive graphics.

48540 (AD-A—061624) **Transient analysis of power transmission lines using the digital computer. Master's thesis.** Benson, J.D. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 26 Aug 1977. 100p. NTIS PC A05/MF A01.

A method is presented for modeling a transmission line for transient analysis study on the digital computer. The line is modeled as a finite number of lumped parameter sections. Each section is modeled in an equivalent section of resistors and current sources developed from solving the voltage and current equations by the trapezoidal rule for integration. The integration takes place over a period of time from a known state, t, to an unknown state, t + delta t. The time step, delta t, is taken to be the lossless travel time for the traveling wave to cross each section. The single phase lossless case is handled first, then losses are accounted for, and finally the three phase line is dealt with.

48541 (EPRI-EA—1080) **Right-of-way ecological effects bibliography.** Galvin, M.T.; Cupit, R.D. (Asplundh Environmental Services, Willow Grove, PA (USA)). May 1979. 258p. Dep. NTIS, PC A12/MF A01.

This report consists of an annotated bibliography containing 824 citations of documents covering the published state-of-the-art through 1977 in describing ecological effects of overhead transmission line rights-of-way. The citations are indexed according to author, subject, and ecological region.

AC SYSTEMS, EHV AND UHV

48542 (JPL-PUB—79-35(Vol.1)) **Proceedings of the Distribution Automation and Control Working Group. Volume I: Executive summary.** (Jet Propulsion Lab., Pasadena, CA (USA)). Mar 1979. 33p. (CONF-7811130—P1(Summ.)). Dep. NTIS, PC A03/MF A01.

From Distribution automation and control working group; Baltimore, MD, USA (20 Nov 1978).

Results are presented of the Working Group Meeting for Distribution Automation and Control (DAC) on the Electric Power System held on November 20—22, 1978 at Baltimore, Maryland. Its purpose was to bring together some members of the electric utility community so that they might reach a common understanding on: key issues and uncertainties to be resolved; the existing state of the art; and specific requirements for further RD and D in the area of DAC. The meeting consisted of several presentations and working sessions. The statements and recommendations formulated by the group on various topics are presented.

SUPERCONDUCTING AND CRYOGENIC SYSTEMS

48543 **Performance of a liquid helium refrigerator operated above the critical temperature.** Dean, J.W.; Stewart, W. (Los Alamos Scientific Lab., NM). pp 629-634 of Proceedings of the seventh international cryogenic engineering conference. Guildford, England; IPC Science and Technology Press (1978).

From 7. cryogenic engineering conference; South Kensington, London, UK (4 Jul 1978).

A helium refrigerator designed to provide refrigeration at 4.4 K by evaporating liquid helium can also be operated as a gaseous helium refrigerator above the critical temperature. The performance of a commercially available liquid helium refrigerator between 4.4 and 16 K for several different operational modes and flow impedances has been measured. Refrigerator performance is reported.

NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 48315

48544 (DOE/ET—0089) **Fission energy program of the U.S. Department of Energy. FY 1980.** (Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs). Apr 1979. 315p. Dep. NTIS, PC A14/MF A01.

This document presents the baseline implementation program plan as of January 1979 and is derived from the National Energy Plan and other major policy documents. The document discusses civilian nuclear power development, the policy for which has been established by the National Energy Plan of April 1977 and the National Energy Act of 1978. It derives the fission energy policy and program objectives from the National Energy Plan and Act, describes the overall program strategy, and presents the overall budget. The approach used in managing the program, including the program structure and methods used for program control, is explained. The civilian fission power development implementation programs are described in detail. Other considerations affecting civilian nuclear power development are also discussed.

48545 **Fluid structure interaction phenomena in pressure vessel and piping systems.** Au-Yang, M.K.; Brown, S.J. Jr. (eds.). New York, NY; American Society of Mechanical Engineers (1977). 126p. (CONF-771120—P6). ASME, United Engineering Center, 345 E. 47th St., New York, NY.

From Winter annual meeting of the American Society of Mechanical Engineers; Atlanta, GA, USA (27 Nov 1977).

Separate abstracts are presented for papers concerning hydrodynamics and stress analysis of components for large thermal power plants.

48546 (INIS-mf—4590) **Nuclear Energy Agency. 6. activity report. 1977.** (Nuclear Energy Agency, 75 - Paris (France)). 1978. 112p. Dep. NTIS (US Sales Only), PC A06/MF A01.

NEA has, as a primary objective, to ensure through international co-operation that the nuclear option is available for consideration in its true worth. The safety and regulatory aspects of nulear development have represented in 1977 about two thirds of NEA's

total effort; and a high degree of priority was given to questions of nuclear safety and of radioactive waste management. Similarly, the growing need of Member countries for an integrated appraisal of technical, economic, safety, environmental and political questions influencing the nuclear fuel cycle was increasingly taken into account. Finally, a general effort was made to achieve greater visibility for the positive results of the NEA programme, as a contribution to improved public understanding of the factors underlying nuclear power programmes. As in previous years, the NEA programme continued to involve close collaboration with the International Atomic Energy Agency (IAEA) and the Commission of the European Communities. Within the OECD, close collaboration was maintained with the Combined Energy Staff and the Environment Directorate.

48547 (NUREG—0576) **Nuclear power reactor security personnel training and qualification plan reviewer workbook.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jun 1979. 83p. NTIS.

The Training and Qualification Plan Reviewer Workbook has been developed to provide the information required for evaluating the adequacy of the Training and Qualification (T and Q) Plans developed to meet the requirements of 10 CFR 73.55(b)(4) and 10 CFR 73, Appendix B (Published in final form in August 1978).

48548 (NUREG/CR—0534) **Automated personnel data base system. Final report.** Deppner, F.O.; Kennerly, R.G. II; Brooks, H.; Runge, C.D. (General Research Corp., McLean, VA (USA)). May 1979. 244p. NTIS.

This document is the General Research Corporation (GRC) final report on Task VI, which called for the development of a Personnel Automated Data Base System. This system has been identified as the Personnel, Assignment, Qualification, and Training System (PAQTS). Developing this system involved preparing batch- and interactive-type software. The data in the system are obtained from the existing NRC Personnel System (PARIS) and the NRC/IE offices. The data base is composed of two principal files: the basic personnel data with recurring data segments, and the position data. The PARIS data are input on a monthly basis by batch-type software, whereas the data from the NRC/IE offices are input by interactive-type software. The interactive-type software may be utilized by HQ NRC/IE or the regions. This system will aid the NRC/IE personnel in administering the training and reassignment of personnel involved in the nuclear reactor construction and operations inspection program.

POWER REACTORS, NON-BREEDING, LIGHT-WATER MODERATED, BOILING WATER COOLED

REFER ALSO TO CITATION(S) 48642, 48697, 48709, 48712, 48717, 48718

48549 (CDAP-TR—056) **Code Development and Analysis Program: cladding mechanical limits (CMLIMT).** Hagrman, D.L. (Idaho National Engineering Lab., Idaho Falls (USA)). May 1979. Contract EY-76-C-07-1570. 49p. Dep. NTIS, PC A03/MF A01.

Revised models are described for cladding mechanical limits. The update incorporates important new data from several Nuclear Regulatory Commission and German experimental programs and defines a single physically reasonable failure criterion for cladding under tensile stress. Alternate simplified expressions are also derived for use in obtaining estimates of typical cladding shape after burst.

48550 (CONF-790655—6) **JAERI instrumented spool piece performance in two-phase flow.** Colson, J.B.; Gilbert, J.V. (Idaho National Engineering Lab., Idaho Falls (USA)). 1979. Contract EY-76-C-07-1570. 33p. Dep. NTIS, PC A03/MF A01.

From Colloquium on two-phase instrumentation; Idaho Falls, ID, USA (11 Jun 1979).

Instrumented spool pieces to be installed in horizontal piping on the Cylindrical Core Test Facility (CCTF) at the Japanese Atomic Energy Institute (JAERI) have been designed and tested. The instrumented spool pieces will provide measurements from which mass flow rates can be computed. The primary instruments included in the spool pieces are a full-flow turbine, a full-flow perforated drag plate, and a low energy three-beam photon densitometer. Secondary instruments are provided to measured absolute pressure, fluid temperature, and differential pressure across the full-flow perforated drag plate.

48551 (DNS-D—1-019(Vol.2)) **Chemical cleaning of the corrosion fatigue loop at Dresden-1. Volume 2, sections 7.0 - 7.2.** (Dow Chemical Co., Midland, MI (USA)). 26 Aug 1978. Contract EY-76-C-02-4014. 86p. Dep. NTIS, PC A05/MF A01.

The radionuclide concentrations of the Dresden-1 decontamination pilot loop were determined by gamma spectroscopy. The General Electric Ge(Li) pipe gamma scanning system was utilized to take measurements at eight locations both before and after the pilot demonstration of decontamination process. Dose rate measurements were taken with a Cutie Pie at 30 additional locations. The percentage of Co-60 removed was calculated and the results were interpreted. Design drawings for the decontamination pilot loop are included.

48552 (DOE/TIC—10141) **Corrosion studies of nuclear piping in BWR environments. Quarterly report for the quarter ending December 31, 1978.** Park, J.Y.; Danyluk, S.; Shack, W.J. (Argonne National Lab., IL (USA)). Dec 1978. Contract W-31-109-ENG-38. 23p. Dep. NTIS, PC A02/MF A01.

Intergranular stress-corrosion crack (ISCC) tests on sixteen sensitized WOL specimens in high-purity water with 8 ppM oxygen at 289°C were carried out for total accumulated test times of up to 6.48 Ms. Initiation and propagation of an ISCC to ~ 0.1 mm was observed in one specimen (initial load 34 MPa.m/sup 1/2/, test time 6.48 Ms). No evidence of ISCC was observed in the other specimens. In some unfunded exploratory studies related to grain-boundary chemistry, Type 304 stainless steel was found to be susceptible to intergranular gracture upon mechanical impact after an appropriate heat treatment was given. The heat treatments that produce this fracture mode were identified for six heats of material.

48553 **Operational experience in KWU boiling water reactors.** Riess, R.; Henzel, N.; Froehlich, K. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). pp 225-234 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

Operating experience at four reactors, namely Gundremmingen, Lingen, Wurgassen and Brunsbuttel is given. Water chemistry requirements, design of isolant systems and feedwater quality are included.

48554 (NUREG—0020(Vol.3)(No.5)) **Licensed operating reactors. Operating units status report, data as of 4-30-79.** (Nuclear Regulatory Commission, Washington, DC (USA)). May 1979. 185p. NTIS $10.00.

This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices and IE Headquarters; and the third section is an appendix containing comparative statistics of US nuclear/fossil capacity, identification of nuclear power plants within regional Electric Reliability Councils, the relative status of US nuclear electric production to all US electric production by state, and selected Edison Electric Institute operating statistics.

48555 (NUREG/CR—0727) **Boiling water reactor off-gas systems evaluation.** Keller, J.H.; Hoza, M.; Lo, R.; McClure, L.W.; Ayers, A.L. Jr.; Barrett, L.H. (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1979. Contract EY-76-C-07-1570. 55p. Dep. NTIS, PC A04/MF A01.

An evaluation of the off-gas systems for all 25 operating Boiling Water Reactors (BWR) was made to determine the adequacy of their design and operating procedures to reduce the probability of off-gas detonations. The results of the evaluations are that, of the 25 operable units, 13 meet all the acceptance criteria. The other 12 units do not have the features needed to meet the criteria, but have been judged to have, or are committed to provide, features which give reasonable assurance that the potential for external off-gas detonations is minimized. The 12 units which did not originally meet the criteria are aware of the potential hazards associated with off-gas detonations and have agreed to take action to minimize the probability of future detonations.

48556 **Condensate and radioactive water treatment using powdered resin systems.** Jackson, E.W. (Permutit Co. Ltd., London (UK)). pp 459-466 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

The use of powdered ion exchange resins, in particular the Powdex process, for condensate polishing in BWR, PWR and AGR reactors is described. Processing of liquid and solid radioactive wastes is briefly mentioned.

48557 **On-load chelating agent treatments for conventional and nuclear power stations.** Turner, D.J. (Central Electricity Research Labs., Leatherhead (UK)). pp 417-422 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

The paper is concerned with the application of on-load chelating agent treatments to those types of water circuit for which they

are not currently available: high pressure drum boilers, sub-critical once-through boilers and water reactors. An attempt was made to see whether the most thermally stable types of chelating agent are likely to be sufficiently strong chelating agents either to dissolve established Fe_3O_4 deposits or to prevent their precipitation from solution. It seems likely that they are strong enough to prevent Fe_3O_4 depositing in a once-through boiler, through some may require that mildly reducing conditions are maintained. They would not be effective in a high pressure drum boiler (at 350°C) unless much more strongly reducing conditions could be maintained. For such boilers it would probably be better to seek multidentate ligands of less than maximum thermal stability. There are some indications that chelating agents based on carbon chains are more stable than NTA or EDTA so that citric acid or some of the unidentified chelating agents recently found to be produced radiolytically may have potential in the treatment of high pressure drum boilers. The prospects for periodic full-load cleaning seem less good for both types of boiler. There may also be a role for radiolytically produced chelating agents in alleviating some of the problems caused by the deposition of radioactive corrosion products in water reactor circuits. The chances for successful development fall from quite good to very low down the series SGHWR moderator circuit, PWR primary circuit, ammonia dosed BWR, neutral chemistry BWR (including SGHWR).

48558 Distribution of iodine between water and steam: a reassessment of experimental data on hypoiodous acid. Turner, D.J. (Central Electricity Research Labs., Leatherhead (UK)). pp 489-497 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

A re-analysis has been made of published data on the steam/water distribution of iodine between 118° and 287°C. The analysis assumes that the principal reactions are as follows: $I_2 + H_2O = HIO + H^+ + I^- \; 3I_2 + 3H_2O = IO_3^- + 5I^- + 6H^+$ for which the equilibrium constants are respectively K_2 and K_5. The analysis of the experimental data was supported by using empirically and theoretically based equations which describe the temperature dependence of equilibrium constants and by comparing predicted behaviour with the observations reported from a number of boiling water reactors.

48559 EPRI programs in power reactor radiation control. Shaw, R.A. (Electric Power Research Inst., Palo Alto, Calif. (USA)). pp 203-206 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

EPRI is presently supporting research on radiation control techniques for light water nuclear power plants. Nine different contractors working on twelve different contracts are addressing radiation control through techniques such as corrosion control, high temperature filtration, plant operational control, and decontamination. Initial studies have shown that plant piping radiation fields, resulting primarily from the decay of Co-58 and Co-60, are increasing at 25-150 mR/h per full power year.

48560 VGB specifications for waters in nuclear power stations with light water reactors. Schroeder, H.J. (Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Biblis (Germany, F.R.). Betriebsverwaltung). pp 19-24 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

Recommendations on standardisation in the field of water chemistry in nuclear power stations with light water reactors are given. Sampling points and composition properties and treatment of feedwater, reactor water, steam generator water, condensate and make-up water are included.

48561 Ferritic versus austenitic steels in boiling water reactors: compatibility aspects. Tyzack, C.; Berry, R. (UKAEA, Risley. Nuclear Power Development Establishment). pp 77-87 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

The paper presents the rationale for use of carbon and low alloys steels as primary circuit and feed-water heater materials in a future Commercial SGHWR reactor operating under neutral oxygenated conditions. Supporting experimental data are summarised.

POWER REACTORS, NON-BREEDING, LIGHT-WATER MODERATED, NON-BOILING WATER COOLED

REFER ALSO TO CITATION(S) 48549, 48550, 48554, 48556, 48557, 48560, 48569, 48642, 48690, 48692, 48693, 48694, 48697, 48701, 48702, 48704, 48705, 48707, 48708, 48709, 48712, 48716

48562 (CEA-CONF—3991) **Reactor power variations in connection with electric network needs and grey rod use for power plant load management.** Baboulin, J.P.; Bergeron, J.; Micaux, B. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. des Reacteurs a Eau). 1977. 52p. (In French). (CONF-7705166—1). Dep. NTIS (US Sales Only), PC A04/MF A01.

From French-Soviet colloquium on the operation of power plants equipped with water reactors; Moscow, USSR (31 May 1977).

The essential requirements of the power network management of a nearly homogeneous park of power plants are reviewed. Load management needs thus identified cannot be fulfilled in the present state of the art of PWR type reactors, in view of the important distortions in power distribution, created by the power transients, distortions which cannot be evaluated using the present nuclear instrumentation. A change in the reactor control systems is thus envisaged, that is to say the replacement of part of the black element clusters used for regulation, by a less absorbing cluster assembly so-called 'grey' rods. The penalties induced by said rods being much less severe than that induced by the black rods, the versatility of the reactor management is considerably improved, with furthermore, an important reduction in the production of radioactive effluents. An approach of the problem posed by 'grey' rods in the special case of a mean power reactor is presented. Results show the feasibility of an application to a high power nuclear power plant.

48563 Chemical dissolution of Fe(III) oxide. Bradbury, D. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp 373-376 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

Boiling water reactors that employ an oxidising coolant chemistry incur pipework deposits that are commonly based upon ferric oxide. Removal of these deposits by chemical dissolution is an important technique for assisting the maintenance and repair of reactor components. Some studies have been undertaken to examine the kinetics of ferric oxide dissolution in a variety of chemical media in an attempt to provide information for the improvement of reagent formulation.

48564 (UCID—18129) **Technical evaluation of the susceptibility of safety-related systems to flooding caused by the failure of non-Category I systems for Turkey Point Nuclear Power Plant, Units 3 and 4.** Collins, E.K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Aug 1979. Contract W-7405-ENG-48. 18p. Dep. NTIS, PC A02/MF A01.

Three separate reviews of the Turkey Point Units 3 and 4 were conducted by the FPLCO between 1972 and 1975. Initially, at the request of NBC in 1972, the FPLCO reviewed several water systems as sources of flooding. Subsequently, as a result of an abnormal occurrence, the drainage system was reviewed. Finally, the facilities were again reviewed at NRC's request and both the potential sources of flooding and safety-related equipment which could be damaged by flooding were identified. The sources of flooding and the appropriate safety equipment are discussed. An evaluation is presented of measures that were taken by FPLCO to minimize the danger of flooding and to protect safety-related equipment.

48565 (WAPD-MRP—151) **Shippingport Atomic Power Station (PWR). Technical progress report, July 26, 1978—January 25, 1979.** (Bettis Atomic Power Lab., West Mifflin, PA (USA)). 1979. Contract EY-76-C-11-0014. 45p. Dep. NTIS, PC A03/MF A01.

The Shippingport Atomic Power Station was operated with the Light Water Breeder Reactor core at high power levels (base load) until the planned maintenance shutdown from September 15 to October 7, 1978. After returning to power operation, the station was operated in a combination baseload-swingload mode to demonstrate load follow capability of the LWBR core. Evaluation of the core test data taken during the shutdown and during core power operations continues to show that the core is operating in accordance with design predictions. During the periods of power operation only routine corrective and periodic maintenance was required to maintain the operational readiness of the plant. At the end of this report period, the LWBR core had accumulated 9440 EFPH.

48566 (ZJE—213) **Surveillance specimens - part of the reactor pressure vessel reliability and safety program.** Brumovsky, M. (Skoda,

Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1977. 23p. Dep. NTIS (US Sales Only), PC A03/MF A01.

Pressure vessel safety is assessed in the project design stage on the basis of calculations. Owing to the fact that materials differ and operation regimes are not constant, in-service inspections during pressure vessel lifetime must be carried out. The inspections are non-destructive, and destructive, i.e., the so called surveillance specimens programs. Comparisons made of the calculated values for separate areas of the pressure vessel show the importance of both types of in-service inspections.

48567 Some aspects of heat and mass transfer in steam-generating elements of nuclear power plants. Styrikovich, M.A. (AN SSSR, Moscow. Inst. Vysokikh Temperatur). pp 113-117 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

In two-phase systems of very high quality the concentration of salts and strong alkalis in the residual water (in equilibrium state) at pressures, typical for secondary PWR circuits can exceed the average bulk flow concentration by 10^5-10^6 times. Concentration ratio is practically determined by mass transfer intensity between the water boundary layer in contact with the metal and the bulk flow. In the paper results of mass transfer investigations in porous deposits as well as in the post-dry out zone are given.

48568 High temperature magnetic filtration of crud from primary circuit coolant of BWRs. Harding, K. (UKAEA, Winfrith. Atomic Energy Establishment). pp 341-349 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

Development of high temperature magnetic filtration units for use on BWR primary circuits by the UKAEA has reached the stage where a prototype plant has been operated under full circuit conditions at flow rates up to 7.5 te h^{-1}. Filtration efficiency data from this unit with respect to flow rate and particle size distribution is presented, together with analyses of the collected crud. An outline design for a full size magnetic filter is described and the possible effects such a unit would have on the rates of activity build-up on out-of-pile pipework is discussed.

48569 Use of electromagnetic filters in nuclear power plants: experiments and operating experience. Heitmann, H.G. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). pp 351-360 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

Electromagnetic filters have been used for the clean-up of power station waters since 1970. Until now about 40 filters have been in use all over the world and another 40 filters are under construction. So far, they have been used in conventional power stations, in industrial power stations and in nuclear power stations. It is primarily in nuclear power station technology that the use of electromagnetic filters is increasing. This applies to European plants as well as to plants in the USSR and in the USA. Flow rates of up to 3600 t /. h are intended. The objective of further development is to use superconductive coils, in order to generate high magnetic fields so strong that even paramagnetic materials can be separated.

48570 Computer code PACTOLE to predict activation and transport of corrosion products in a PWR. Beslu, P.; Frejaville, G.; Lalet, A. pp 195-201 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

Theoretical studies on activation and transport of corrosion products in a PWR primary circuit have been concentrated, at CEA on the development of a computer code : PACTOLE. This code takes into account the major phenomena which govern corrosion products transport: 1. Ion solubility is obtained by usual thermodynamics laws in function of water chemistry: pH at operating temperature is calculated by the code. 2. Release rates of base metals, dissolution rates of deposits, precipitation rates of soluble products are derived from solubility variations. 3. Deposition of solid particles is treated by a model taking into account particle size, brownian and turbulent diffusion and inertial effect. Erosion of deposits is accounted for by a semi-empirical model. After a review of calculational models, an application of PACTOLE is presented in view of analyzing the distribution of in core.

48571 Chemistry of high temperature phosphate solutions in relation to steam generation. Broadbent, D.; Lewis, G.G.; Wetton, E.A.M. (Central Electricity Generating Board, Hinkley Point (UK)). pp 53-62 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

The problems associated with the use of phosphate for chemical treatment of the P.W.R. secondary circuit have prompted renewed interest in the physical chemistry of these solutions. Solubility and phase studies have been carried out at 250, 300 and 350°C with solutions having sodium to phosphate ratios from 1.0 to above 3.0. A solid phase of ratio about 2.8 exists in equilibrium with a wide range of saturated solution compositions at each temperature. Invariant points at which three phases are in equilibrium have been identified and at the two higher temperatures a region of liquid-liquid immiscibility occurs. Phase diagrams have been constructed for each temperature from which it is possible to predict the compositional changes occurring during the isothermal evaporation process. The corrosivity of these phosphate solutions to a range of steel alloys is being studied, the results reported in the present work, however, are confined to mild steel in the temperature and phosphate composition ranges of the phase studies. The corrosion of mild steel is generally considerably less than in sodium hydroxide solutions of equivalent concentration. The dependence of corrosion rate on sodium and phosphate concentrations in not readily explicable in terms of the solubility and phase studies and it is thought that the solubility of iron in the phosphate solutions is an important rate-determining factor since several complex compounds containing sodium, phosphorus and ferrous iron are present in the corrosion films.

48572 Recent improvements in the filtration of corrosion products in high temperature water and application to reactor circuits. Darras, R.; Dolle, L.; Chenouard, J.; Laylavoix, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). pp 361-368 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

A considerable limitation of radioactivity transportation in the primary circuit components of pressurized water reactors is only possible through extraction of the corrosion products by filtration at a rate adequate to minimize the amount of crud deposited in the core. This extraction rate has been estimated; its magnitude implicates a filtration operating on the high temperature water in the primary circuit, which allows the necessary high flows. The application of magnetic and electromagnetic, so as deep granular graphite bed filters, has been studied. The results concerning efficiencies and limiting yields at high temperatures are given. Estimates concerning technological feasibility and corresponding investments are discussed.

48573 Transfer of chemicals in PWR systems: secondary side. Jonas, O. (Westinghouse Electric Corp., Philadelphia, Pa. (USA)). pp 445-457 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

Transfer of chemicals in the secondary side of pressurized water reactor systems with recirculating and once-through steam generators is considered. Chemical data on water, steam and deposit chemistry of twenty-six operating units are given and major physical-chemical processes and differences between the two systems and between fossil and PWR systems are discussed. It is concluded that the limited available data show the average water and steam chemistry to be within recommended limits, but large variations of impurity concentrations and corrosion problems encountered indicate that our knowledge of the system chemistry and chemical thermodynamics, system design, sampling, analysis and operation need improvement.

48574 Estimation of activity inventories in primary circuits of pressurized water reactors. Roesmer, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)); Rootham, M.W. pp 187-193 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

Recent measurements of surface concentrations of deposits on eleven Westinghouse PWR cores, and the determination of metal release rates from corroding Type 304 stainless steel and from Inconel-600 under chemical and thermohydraulic conditions approaching those in PWRs, are used to estimate crud activity levels expected after two and twelve months of operation of a typical 1000 MW(e) plant.

48575 Full flow condensate polisher experience in the secondary water chemistry control of PWR plant. Rootham, M.W. (Westinghouse Electric Nuclear Energy Systems Europe (WENESE), Brussels (Belgium)); Philippe, R. pp 43-52 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

Operating experience of the condensate polishing system at the Doel power plant is given. Initial problems, performance testing,

leaks and sodium slip are included. It is concluded that a condensate polishing system cannot be regarded as a realistic substitute for a leak tight condenser.

48576 Overview of water chemistry for pressurized water nuclear reactors. Solomon, Y. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). pp 101-112 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

The intense radiation in a PWR affects the water used to cool the fuel and moderate the neutrons. This radiation influences the corrosive properties of the coolant and limits the water treatment options. The major problem in primary coolant technology today is the exposure of personnel due to radioactivation of corrosion products. Corrosion problems on the secondary side of the steam generators are associated with local regions where trace impurities can concentrate.

48577 Investigations on the vibrative excitations of PWR pressure vessel and internals by pressure noise analysis and model calculations. Bauernfeind, V. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)). pp 323-332 of Reactor noise: SMORN II. Williams, M.M.R. (Queen Mary Coll., London (UK). Dept. of Nuclear Engineering) (ed.). Oxford; Pergamon Press Ltd. (1977).

From Specialists meeting on reactor noise; Gatlinburg, TN, USA (19 Sep 1977).

In connection with a programme on the influence of mechanical vibrations on reactor noise signals, a report is presented dealing with spectral deviations caused by mechanical effects, i.e. changes of the excitation or of the structural frequency characteristic. The vibrative excitation has been investigated by correlative analysis of the pressure noise signals. Theoretical models of the vibrating structures have been developed. The first part of the report discusses the development of computer programmes, the specification of the model parameters, and the composition of the excitation matrix. The second part is concerned with the interpretation of vibration power spectral densities, which had been measured at the STADE nuclear power plant during the pre-operational test and the first period of power operation.

48578 PWR internals vibrational mode shapes calculation and tests. Carre, J.; Gibert, R.J.; Jeanpierre, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. d'Etude et de Developpement des Reacteurs); Assedo, R. pp 353-362 of Reactor noise: SMORN II. Williams, M.M.R. (Queen Mary Coll., London (UK). Dept. of Nuclear Engineering) (ed.). Oxford; Pergamon Press Ltd. (1977).

From Specialists meeting on reactor noise; Gatlinburg, TN, USA (19 Sep 1977).

In the case of Pressurized Water Reactors (P.W.R.) the core is contained in a cylindrical core barrel, surrounded by a thermal shield, with its top rim at the vessel flange. The coolant flow along those internals is highly turbulent and induces some structure vibrations. The barrel and thermal shield motion change more or less the neutron transmission through the water annulus: consequently, the resonant frequencies of structural vibrations may induce resonances on the power spectral density of ion chamber current. The relative amplitude of the neutron noise and mechanical resonances depends on the mode shapes. A good knowledge of these modal shapes is necessary to make a good interpretation of neutron noise result. Obtained from a French computer system called AQUAMODE-TRISTANA, using the modal coupling of sub-structures, taking into account the liquid effects by finite elements and using experimentally deduced turbulent pressure forcing functions, the resonant frequencies, modes shapes and amplitudes of P.W.R. internals (900 MW, three loops) are presented in the paper. These results are in good agreement with experimental results obtained on the SAFRAN Loop which consists of a reduced scale model of three loops P.W.R. primary circuit and reactor internals and on the FESSENHEIM reactor during cold flow tests.

POWER REACTORS, NON-BREEDING, GRAPHITE MODERATED

REFER ALSO TO CITATION(S) 48181, 48689, 48934

48579 (CONF-790402—24) **Exploiting the steady state, continuous fueling reactor model.** Vondy, D.R.; Cunningham, G.W.; Fowler, T.B. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 19p. Dep. NTIS, PC A02/MF A01.

From Computational methods in nuclear engineering; Williamsburg, VA, USA (23 Apr 1979).

A continuously fueled reactor presents an analysis challenge, especially so when the neutron accounting is sensitive to the core design and the fuel handling. A scheme was implemented to solve the steady state, continuous fueling problem. This problem is an accurate model of the reactor for assessing performance at a point in its operating history. Available capability in a modular code system developed to treat fixed fuel reactors was extended in this effort. Parametric studies have been made with this capability to assess the performance of a pebble bed power plant reactor over a wide range of fueling possibilities. The model and the calculational methods are discussed. A global iteration scheme is used to effect a solution for the critical reactor state. The schemes used to accelerate the rate of convergence of one- and two-dimensional problems are described and the interactive behavior is shown for representative problems.

48580 (CONF-790572—2) **PCRV design verifiction and support at Oak Ridge National Laboratory.** Callahan, J.P. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 23p. Dep. NTIS, PC A02/MF A01.

From Helium Breeder Associates/US Dept of Energy GCFR technical meeting; San Diego, CA, USA (30 May 1979).

For more than a decade, a comprehensive program of analytical and experimental studies of prestressed concrete reactor vessels (PCRVs) and related technology has been conducted at Oak Ridge National Laboratory (ORNL) under the auspices of the Department of Energy and its predecessors. The program has been directed primarily toward gas-cooled reactors since they are the only reactor concepts utilizing PCRVs. The goals of the program are to provide technical support for ongoing PCRV design activities, contribute to the technological data base, and provide independent review and evaluation of the relevant technology. The tasks selected for implementation are identified through direct communication with the PCRV designers, through participation in ACI-ASME design code activities and based on the findings of literature reviews and communications with researchers in other countries. Current areas of study encompass analysis methods, materials properties, instrumentation, and structural models. Although the major portion of the overall effort is supported by the HTGR Base Technology Program, the task areas are generic in nature and are therefore relevant to the GCFR as well.

48581 (GA-A—15436) **HTGR gas turbine program. Semiannual progress report for the period ending March 31, 1979.** (General Atomic Co., San Diego, CA (USA)). Jun 1979. Contract EY-76-C-03-0167-046. 217p. Dep. NTIS, PC A10/MF A01.

The conceptual design and analysis performed by General Atomic Company for the US Department of Energy on the direct cycle gas turbine high-temperature gas-cooled reactor (GT-HTGR) are described. Three GT-HTGR plant concepts were studied: 1200-MW(e) three-loop non-intercooled cycle, 1200-MW(e) two-loop intercooled cycle, and 600-MW(e) one-loop intercooled cycle (demonstration plant). General Atomic co-operated with the German/Swiss HHT project on the development of the GT-HTGR concept in the areas of systems analysis, safety and accident analysis, and PCRV-liner-internals design.

48582 (Juel—1513) **Investigations for the mechanical and nuclear realisation of a pressure-vessel built-up of cast-steel-segments for a high-temperature reactor with a power of 3000 MWsub(th).** Grebe, H.W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Jun 1978. 131p. (In German). Dep. NTIS (US Sales Only), PC A08/MF A01.

Thesis.

Presently for gas-cooled reactors prestressed concrete vessels made of prestressed concrete are inserted. An alternative to the prestressed concrete vessel is the prestressed cast-steel vessel, whose mechanical and nuclear realisation is investigated in this report. On the basis of defined interpretation criteria the dimensioning calculations for the necessary cast-steel and prestressed steel-segments are performed as well as voltage gradients and deformation status for different load situations are determined and practically represented, whereby a reactor with ring core is comparative confronted to a reactor with cylindrical core. In the nuclear part it is tested how far the prestressed cast-steel-vessel suffices as a biological shielding or how far problems are to be expected concerning neutron activation and integrated neutron radiation. Weak points are shown and solution proposals are made.

48583 Water chemistry control and corrosion inhibition in Magnox fuel storage ponds. Case, B. (Central Electricity Research Labs., Leatherhead (UK)); Hilton, D.A. pp 429-436 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

Magnox fuel elements which have completed their useful lifetime in a reactor are generally discharged to storage ponds and thereafter remain under water until they are reprocessed. A basic requirement of the storage condition is the prevention of corrosive penetration of the fuel cladding and within the CEGB water chemis-

try control has principally involved hydroxide dosing to maintain the pH in the passive region for magnesium. The reaction of Magnox AL-80 with water, producing magnesium hydroxide and hydrogen, is affected by low concentrations of anions, such as chlorides and sulphates, which form soluble magnesium salts; these can promote localised pitting even when the general corrosion rate is low. This paper reviews those aspects of water chemistry and metal condition which are important in determining the corrosion behaviour of Magnox AL-80, e.g. in-reactor irradiation, exposure time, anion effects, and also describes some studies of possible alternative pond water chemistries.

48584 Mechanisms of fission product migration in nuclear graphite. Rowland, P.R. (Organization for Economic Co-Operation and Development, Winfrith (UK). High Temperature Reactor Project). pp 479-490 of Fourth London international conference on carbon and graphite. London; Society of Chemical Industry (1976).

From 4. London international carbon and graphite conference; London, UK (23 Sep 1974).

The conditions most likely to cause fission product migration through graphite in a typical high-temperature reactor are identified. The main isotopes of interest retained by graphite in the temperature range 700 to 1250°C are those of Sr, Ag and Cs. Sr appears to migrate by a through-grain mechanism which is little affected by in-pile conditions or graphite type and is slow moving at 1000°C. Ag appears to be strongly adsorbed as an immobile layer on pore walls (in-pile, but not out-of-pile) and to migrate slowly by gas-in-gas diffusion of the vapour in equilibrium with this layer. Cs behaviour is complicated by the occurrence of two mechanisms, one fast, one slow. The effect of graphite structure on these has been analysed out-of-pile but diffusion in-pile appears to be slower, at least for highly crystalline, coarse-grained materials. Thus present data on out-of-pile work are probably pessimistic. The further studies needed are described.

POWER REACTORS, NON-BREEDING, OTHERWISE MODERATED OR UNMODERATED

REFER ALSO TO CITATION(S) 48561, 48937

48585 Mechanisms of some radiation induced oxidations of ferrous ions in aqueous solutions. Jayson, G.G. (Liverpool Polytechnic (UK)); Swallow, A.J. pp 303-310 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

Oxidation reactions of ferrous ions in acidified aqueous solution initiated by .OH, Cl., Cl_2^-., HO_2., RO_2. (organic peroxy) and H. radicals have been investigated using the pulse radiolysis technique. Some of the radicals gave rise to transient outer-sphere ferric complexes (e.g. Fe^{3+} $(H_2O)sup(.)_6,HO_2$) which had distinct absorptions so that rates of formation and decay could be followed. At higher ferrous concentrations absorption due to ferric-X-ferrous bridge transients could sometimes be observed. In the case of HO_2. and RO_2. the rate constants of formation and decay of the transients have been determined and the temperature dependence investigated. The introduction of sulphate into the outer-sphere and its transfer to the inner-coordination sphere of the ferric ion was studied. The action of organic sulphur-compounds on these reactions was considered.

48586 Radiolysis of aqueous solutions of neutron absorbers. Rozenberg, J.; Dolle, L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). pp 299-302 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

The use of soluble neutron absorbers is very convenient in heavy water reactors. Their influence on the radiolytic decomposition of the reactor moderating water must be known. Irradiations by a cobalt-60 source showed that the initial radiolytic hydrogen yield is decreased when salts of elements possessing one stable valence state are added in water. This effect favours the use of salts of cadmium and gadolinium as soluble neutron absorbers. In-reactor experiments confirmed the inhibition of water radiolysis by sulfates of cadmium and gadolinium. Boric acid, another possible soluble absorber, could be used at low concentrations to compensate the xenon-poisoning at start-up in heavy water reactors. It has no effect on the radiation chemistry of the coolant.

POWER REACTORS, BREEDING

REFER ALSO TO CITATION(S) 48565, 48580, 48668, 48695, 48696, 48698, 48699, 48700, 48711, 48714, 48715, 48927, 48928, 48937

48587 (ANL-CT—79-40) **Scale modeling of finite length fluid annular gaps for flow-induced vibration testing.** Mulcahy, T.M.; Miskevics, A.J. (Argonne National Lab., IL (USA)). Jun 1979. Contract W-31-109-ENG-38. 30p. AT.

Possible scale model distortions for structural vibration testing are discussed. Conditions for which fluid energy dissipation is expected to be larger in a reduced scale model than in the prototype are defined. This unconservative and sometimes undesirable distortion is confirmed by testing of a vibrating rod surrounded by a finite length fluid filled annulus. A theory for estimating the magnitude of the distortion is presented.

48588 (CONF-781001—P1) **Third US/USSR LMFBR steam generator seminar. Volume 1. US papers.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). 1978. Contract EY-76-C-03-0893-010. 356p. AT.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

Separate abstracts were prepared for the individual papers presented at the meeting.

48589 (CONF-781001—P1, pp 1.1-1.30) **Design, manufacturing, and test status of the CRBRP hockey stick steam generators.** Lillie, A.F.; Bashford, A.L. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

The history of the development of the hockey stick steam generator, currently being designed and fabricated for use in the CRBRP, is traced back to its inception in the late 1960's. Additional supporting development, which has formed the basis for the current CRBR design, is presented. The design requirements for the CRBR steam generators is outlined and the basic design, which has been evolved to meet those requirements, is described. Of particular interest to the designer are the design analysis problem areas which have been encountered and the method of attack which has been employed to resolve these problems. Finally, the current status of the prototype and CRBRP steam generator plant unit production effort is described. Tube-tubesheet welding and welding of shell sections is discussed.

48590 (CONF-781001—P1, pp 2.1-2.12) **Fabrication and inspection of tubing, tubesheets, and tube-to-tubesheet welds for the CRBRP steam generators.** Spalaris, C.N.; Durand, R.E.; McClung, R.W.; Wright, E.A. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

The rationale for the technical details leading to the selection of tubing and tubesheet specifications and inspection techniques was based upon the desire to optimize the chances of success for the CRBRP steam generators. Fabrication processes, especially welding for the tube-to-tubesheet joints were recognized as critical. Thus, heavy emphasis was placed upon the development of reliable welding techniques as well as inspection methods using the most accurate and sensitive tools available. Accomplishments to date include: (a) the procurement of the tubing and tubesheets, to the desired specifications; (b) validation that the design base properties of wrought products are well within code acceptable levels; and (c) development of welding and tube-to-tubesheet inspection methods to provide satisfactory levels of quality.

48591 (CONF-781001—P1, pp 3.1-3.34) **Design approaches and programs for development of steam generators for U.S. LMFBR plants beyond CRBRP.** Stone, C.C. (Argonne National Lab., IL); Ford, J.A.; McDonald, J.S.; Lohmeier, A.; Grant, G. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

The advanced steam generator program in the U.S. for LMFBR Plants consists of base technology and development of three large-scale steam generator design concepts. A feasibility scale-up of the CRBRP hockey stick design steam generator for application in the Prototype Large Breeder Reactor (PLBR) has been performed by the Atomics International Division of Rockwell International. A single-wall helical-coil steam generator is being developed by Babcock and Wilcox Company and a double-wall straight-tube concept is being developed by the Tampa Division of the Westinghouse Electric Corporation. This paper gives a description of each of the three concepts, basis for selection and the main factors considered. The development that has been completed in support of the hockey stick design is described and the planned development and testing programs to support the double-wall and helical-coil designs are outlined. Two alternate steam cycles are being considered and a 70 MWt prototype for both the double-wall and helical-coil concepts is planned to be designed, fabricated and tested after selection of a single reference steam cycle for each of the concepts.

48592 (CONF-781001—P1, pp 4.1-4.12) **Decarburization of 2-1/4Cr—1Mo in flowing sodium.** Roy, P.; Hampton, L.V.; Spalaris, C.N. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

The Intermediate System Mock-up Sodium Loop (ISML) was designed to model a bi-metallic (austenitic stainless and 2-1/4Cr—1Mo ferritic steel) LMFBR intermediate heat transport system. The objective of the loop is to establish decarburization kinetics of 2-1/4Cr—1Mo as well as carburization rates for Types 304 and 316 stainless, operative in an intermediate heat transport sodium loop. It is intended to verify design basis assumptions made for the CRBRP regarding carbon transport in the secondary system. This loop has operated for about 11,000 hours. The specimens tested include prototypical materials used for the fabrication of CRBRP steam generators, as well as experimental heats controlled to test the effects of remelt refining processes. Activation energies have been obtained for decarburization rates for electroslag remelt (ESR) and vacuum arc remelt (VAR) materials produced from the same air melted ingot. Geometry effects of test samples have been investigated and time dependence was established for the decarburization constants. Carburization rates in this loop for Type 304 stainless were found to be lower than the previous data band.

48593 (CONF-781001—P1, pp 5.1-5.32) **Corrosion and impurities deposition effects under DNB conditions.** Rush, D.J.; Hampton, L.V; Spalaris, C.N.; Schmidt, D.K.; Padden, T.R. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

A summary of two separate steam generator model test programs, including a description of the test models, test systems, control and monitoring of water chemistry, in situ nondestructive examination methods and results, post-test destructive examination methods and results, are presented. The test programs described are: the DNB Corrosion Effects test program conducted by General Electric which comprised a sodium-heated single-wall-tube test model with a single-wall heat transfer tube prototypic of the CRBR steam generator tubing; and the Small Steam Generator Model corrosion test program conducted by Westinghouse which comprised a sodium-heated double-wall tube. The objectives of these tests were to determine whether accelerated or localized damage would occur as a result of DNB operation. The two parameters varied were caustic level and heat transfer. The GE, or prototypic, test was conducted at an extreme condition of the plant specifications: 9 +- 3 ppb Na and thermal conditions corresponding to 64% plant power where the heat flux and tube wall temperature oscillations are maximum. The Westinghouse test was conducted at a 30 ppb sodium ion content to simulate worst-case conditions under which the CRBR might be operated with the thermal conditions corresponding to the less severe 100% power condition.

48594 (CONF-781001—P1, pp 6.1-6.22) **Tube/space plate interactions in sodium cooled fast breeder steam generators.** Wilson, W.L.; Galioto, R.A.; Ring, P.J.; Page, J.P. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

The friction, wear, and self-welding behavior of 2-1/4Cr—1Mo steam generator tubing interacting with tube space plates has been investigated under prototypic LMFBR steam generator service conditions. Dynamic friction and self-welding characteristics were investigated. Subsequent testing involved tube/tube space plate model tests utilizing actual steam generator tubing and spacer plate materials and configurations. Conditions of contact load, stroke, velocity, rubbing distance, sodium temperature, and intermittent dwell periods were investigated. In addition, the behavior of alternate spacer plate materials was evaluated. Dynamic coefficients of friction and breakaway friction coefficients were measured in sodium. Inconel 718 spacer plate material was found to result in a marked reduction in tube wear under all test conditions as compared to the reference 2-1/4Cr—1Mo and alternate spacer plate materials which were evaluated.

48595 (CONF-781001—P1, pp 7.1-7.30) **Heat transfer with hockey-stick steam generator.** Moody, E.; Gabler, M.J. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

The hockey-stick modular design concept is a good answer to future needs for reliable, economic LMFBR steam generators. The concept was successfully demonstrated in the 30 MWt MSG test unit; scaled up versions are currently in fabrication for CRBRP usage, and further scaling has been accomplished for PLBR applications. Design and performance characteristics are presented for the three generations of hockey-stick steam generators. The key features of the design are presented based on extensive analytical effort backed up by extensive ancillary test data. The bases for and actual performance evaluations are presented with emphasis on the CRBRP design. The design effort on these units has resulted in the development of analytical techniques that are directly applicable to steam generators for any LMFBR application. In conclusion, the hockey-stick steam generator concept has been proven to perform both thermally and hydraulically as predicted. The heat transfer characteristics are well defined, and proven analytical techniques are available as are personnel experienced in their use.

48596 (CONF-781001—P1, pp 8.1-8.28) **Thermal-hydraulics in a helical coil tube steam generator.** Kakarala, C.R. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

Thermal-hydraulic considerations play an important part in all stages of the design and development of a steam generator with a high degree of reliability and safety, ease of maintenance, and reasonable first cost. With this perspective, the subject of this paper is presented in three parts: (1) thermal-hydraulic considerations in the selection of the B and W helical coil tube once-through steam generator configuration and other important design parameters; (2) heat transfer and pressure drop correlations and the supporting experimental and theoretical basis; and (3) design and analysis methods for sizing, steady-state and dynamic performance evaluation. The present thermal-hydraulic design and analyses methods and back-up test data provide a sound basis for the design. Additional test programs, analytical model developments, building and testing a prototype, as described in a separate paper, will provide further assurance regarding the reliability of the design. These development programs will also allow further design optimization.

48597 (CONF-781001—P1, pp 9.1-9.26) **Heat transfer with double wall steam generator.** Efferding, L.E.; Waszink, R.P.; Hwang, J.Y. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

Experimental/analytical studies performed to date on the double-wall tube heat transfer-hydraulic development have been addressed to single-tube sodium-heated experience and analysis support. These programs and results are summarized in this paper. Results demonstrate that thermal resistance behavior of the interface clearance of an annealed double-wall tube without grooves is predictable. References tubes employing grooves for leak detection reflect predictable interface thermal resistance behavior within 10% of experimental results derived from a sodium-heated test model. Flow boiling critical heat flux (CHF) data is shown to be unaffected by the behavior of the double-wall variable conductance interface. Use of a gas mixture in the interface of a double-wall tube test model demonstrated the versatility of this concept as a heat-flux-limiting feature without introducing a significant sizing penalty in other regions exposed to lower heat flux. Plans are described for future effort which applies these earlier findings to large steam generator tube bundles and describes the areas where future development is required. These areas of future effort entail thermal/hydraulic stability investigations of a large matrix of flow-boiling circuits, long-term test exposure of prototypic tubing at elevated-temperature, shell-side flow distribution of sodium thorugh a baffled tube bundle reflecting two-dimensional (axisymmetric) and three-dimensional effects experiencing forced- and natural-circulation mechanisms.

48598 (CONF-781001—P1, pp 10.1-10.20) **Recent experimental results on small leak behavior and interpretation for leak detection.** Greene, D.A.; Gudahl, J.A.; Magee, P.M. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

A small leak of water into sodium in an LMFBR steam generator can cause damage to adjacent tubes, a phenomenon termed impingement wastage. The available impingement wastage data are analyzed by considering the sodium-water reaction to be a simple combustion process. This approach permits correlation of data from different facilities and integrates and explains experimental observations. Water leaking into sodium also causes self-enlargement of the defect, or self-wastage. Results of recent experimental tests on the growth patterns of very small leaks are summarized and used to provide estimates of the magnitude of self-wastage phenomena. Steam generator leak protection is strongly influenced by the wastage results. Significant differences in protection exist between evaporators and superheaters due principally to their differences in sodium temperature. Two types of tube defect plugging have been studied: (1) plugging prior to steam generator service due to magnetic formation or the presence of foreign matter; and (2) plugging due to sodium-water reaction products. It is shown that a cleaning solution will open both types of plugs. Experimental studies on pool fire (diffusion flame) damage at sodium surfaces are briefly reviewed.

48599 (CONF-781001—P1, pp 11.1-11.14) **Development of leak detection systems for LMFBR steam generators in the U.S.** Magee, P.M.; Gerrels, E.E.; Greene, D.A.; McKee, J. 1978.
From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

Leak detection for Liquid Metal Fast Breeder Reactor steam generators is an important economic factor in the shutdown, repair and restart of a plant. The paper summarizes U.S. progress in three key technology areas involved in leak detection development: (1) chemical (H_2 and O_2) leak detection meters; (2) acoustic leak detection/location techniques; and (3) data management for plant operations. The status, design aspects, and applications of leak detector technology for LMFBR plants are discussed.

48600 (CONF-781001—P1, pp 12.1-12.30) **U.S. program for large sodium/water reaction tests.** Whipple, J.C.; Amos, J.C.; DeBear, W.S.; Neely, H.H. 1978.
From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

An extensive large leak test program is underway in the United States to investigate the effects of large sodium-reaction events in LMFBR steam generators. The general objectives of the program are to provide data for validating analytical codes, provide information on the extent of secondary tube failures, provide data on relief system performance and provide data on cleanup and recovery needs. Tests are conducted in the Large Leak Test Rig located at the Energy Technology Engineering Center. The program is divided into two phases, Series I and Series II, for the purpose of satisfying near-term and long-term needs. The test article for the Series II tests (the Large Leak Test Vessel/Large Leak Test Internals) has been fabricated. Upon completion of Large Leak Test Rig modification, test article installation, and system checkout Series II testing will begin. The overall program plan is defined, the test articles and test facility are described, and the experimental approach is discussed for both Series I and Series II programs. The Series I test experience and results of intertest examinations are also presented.

48601 (CONF-781001—P2) **Third US/USSR LMFBR steam generator seminar. Volume 2. USSR papers.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). 1978. 356p. AT.
From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).
Separate abstracts were prepared for the individual papers presented at the meeting.

48602 (CONF-781001—P2, pp 1.1-1.20) **Status of development and manufacture of a steam generator for the BN-600 nuclear power reactors.** Titov, V.F.; Lukasevich, B.I. 1978.
From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

The basic results are presented from studies performed in the stage of development of the plan for a concurrent, multi-section steam generator for the BN-600 nuclear powerplant. Thermal and hydrodynamic, strength and vibration, heat-corrosion and operating-life testing of models of the steam generator have confirmed the plan assignments of specification parameters for the steam generator. One section of the PG-2 steam generator, the prototype of the actual steam generator of the BN-600, the manufacture of which has assisted in developing the technological cycle for production of the BN-600 steam generator, has been installed on the BOR-60 steam generator, has been installed on the BOR-60 experimental installation for long-term combined testing.

48603 (CONF-781001—P2, pp 2.2-2.10) **Some estimates of the prospects for dual-wall sodium-water steam generators.** Kokorev, B.V.; Turchin, N.M. 1978.
From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

Steam generators with double tubes practically eliminate the probability of interaction of sodium and water in case of a leak. However, the opinion is still heard that these steam generators are significantly larger and heavier, and higher in initial cost than single-wall generators. Calculated estimates of the variation in heat-exchange surface as a function of thermal resistance of the zone of contact for steam generators with the parameters of the BN-600 installation have shown that the use of double tubes would not lead to an excessive increase in cost. Development of the design of double tubes, allowing easy repair of defective tubes, will make it desirable to manufacture steam generators of large unit power. These designs can be the equal of modular single-wall apparatus.

48604 (CONF-781001—P2, pp 3.1-3.18) **Some results of the study of vibrations and wear in models of the steam generator of the BN-600.** Titov, V.F.; Fedorov, V.G. 1978.
From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

Results are discussed from testing models of the tubes of steam generators for fretting. The parameters of vibration in the models are selected from the results of measurement of vibrations of a multitube steam generator at nominal water flow rates. During the fretting tests, the amplitudes of tube acceleration, compressive forces of the tubes against the spacing grid and water flow rates were varied. A description is presented of the models, the testing methods and methods of processing the results. A comparison of the results produced with data produced earlier is performed and the results are used to estimate the operating life of steam generators.

48605 (CONF-781001—P2, pp 4.1-4.10) **Results of study of American specimens of welded joints between tubes and tubesheets.** Gubanov, V.M.; Sobolev, E.N.; Sokolov, A.S.; Titov, V.F. 1978.
From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

Results are presented from laboratory testing of specimens of welded joints between tubes and tubesheets provided by the American side. The tests were conducted in the USSR in accordance with the cooperative plan.

48606 (CONF-781001—P2, pp 6.1-6.22) **Model thermal corrosion testing of the BN-600 steam generator.** Titov, V.F.; Gubanov, V.M.; Sobolev, E.N.; Sokolov, A.S.; Lukasevich, B.I. 1978.
From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

Results are presented from thermal corrosion testing of models of the steam generator of the BN-600, operating life up to 12,000 hours, as well as information on the design of the models, the experimental test stand, the methods of conduct of the tests and of processing of the experimental results. Based on the experimental studies, it is shown that the 12KH2M steel used for the model evaporator and the KH18N9 steel used for the steam generator, under the planned operating conditions, can provide reliable operation of the steam generator for the assigned operating life.

48607 (CONF-781001—P2, pp 9.1-9.22) **Problems of heat exchange and hydrodynamics of sodium-water steam generators for fast-neutron reactors.** Kirillov, P.L.; Ushakov, P.A.; Grachev, N.S. 1978.
From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

this report contains a review of the problems and tasks related to the heat exchange and hydrodynamics of sodium-water steam generators, as related to the program of development of fast-neutron reactors. The hydrodynamics of these steam generators on the sodium side are significantly more important than has been thought up to now. Examples are presented of hydrodynamic effects. A general description of heat transfer from the sodium is discussed without reference to any specific design of steam generator. The characteristics of heat transfer on the water side and in the steam-water mixture are analyzed as applicable to the design of a steam generator with straight tubes. Information on heat-exchange crisis in a two-phase flow under various conditions, and the phenomena accompanying it are discussed separately, and problems of heat exchange in the supercritical zone of a steam generator are also discussed. A number of other phenomena are mentioned, related to deposits in steam generators, corrosion, plugging of tubes and other problems, which must be considered during design.

48608 (CONF-781001—P2, pp 11.1-11.30) **Small leaks of water into sodium and their detection by concentration methods.** Kozlov, F.A.; Sergeyev, G.P.; Poplavskii, V.M.; Sednev, A.R.; Borisov, V.V.; Makarov, V.M. 1978.
From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

Reports are presented from studies of the spontaneous development of small leaks of water into the sodium, and methods of their recording on the basis of the hydrogen concentration in the sodium and in the protective gas are discussed. Based on a calculation model, an estimate is presented of the coefficient of hydrogen leakage into the gas space of a steam generator upon appearance of leaks of water into the sodium. The calculation results are compared with the values of leakage coefficient determined experimentally. Possibilities of detecting leaks using hydrogen detectors are analyzed as applicable to the conditions of the BN-350 and BN-600 installations.

48609 (CONF-781001—P2, pp 12.1-12.18) **Experimental study of abnormal processes with small leaks of water into sodium in models of steam generators of reverse design.** Poplavskii, V.M.; Bagdasarov, Yu.E.; Kozlov, F.A.; Sergeyev, G.P.; Borisov, V.V.; Sednev, A.R. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

This report describes the basic peculiarities of reverse type steam generators, the advantages and disadvantages of the design. A description is presented of experimental devices used to study abnormal processes, and the research method is outlined. Based on the experimental results produced, conclusions are drawn concerning possible advantages of reverse steam generator design for sodium-water steam generators, from the stand-point of decreasing abnormal effects resulting from contact between the two media.

48610 (CONF-781001—P2, pp 13.1-13.26) **Influence of heat exchange between reaction products of the interaction of sodium with water and structural elements of the steam generator on the parameters of the large leak emergency mode.** Poplavskii, V.M.; Leonchuk, V.N. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

In this work, an attempt is made to analyze the temperature state of the material of the wall of a heat-transmitting tube in a steam generator in the area of a large leak of water into the sodium, considering its cooling by the steam-water flow, in order to predict the possibility of secondary ruptures. Physical and mathematical models of the process of heat exchange between the reaction products and the tube bundle of the steam generator in the large leak mode are suggested. The calculated results are compared with experimental results. The possibility of secondary ruptures is analyzed for the case of an instantaneous large leak of water into the sodium under the conditions found in a full-scale steam generator.

48611 (CONF-781001—P2, pp 15.1-15.28) **Experience of the operation of leak-testing systems of sodium-water steam generators of the BN-350 installation.** Kozlov, F.A.; Kuznetsov, E.K.; Kozub, P.S.; Demin, A.A.; Samarkin, A.A.; Shvedenko, I.M.; Grebenshchikov, Yu.E. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

This report presents materials on the experience of operation of the leak detection system in the steam generators, used to test the hydrogen content in the protective gas and the sodium of the BN-350 installation. The selection of the systemm and its parameters are described, and examples are presented of the detection of leaks during operation of the steam generators. In the system which tests for leaks by hydrogen analysis in the protective gas, sodium vapor is trapped by a special filter. The use of a conductometric analyzer allows the detectior of changes in hydrogen concentration in the protective gas of about 0.005 vol. %. It has been found that in some evaporators, the quantity of sodium contained in the flow of gas being analyzed is many times the calculated quantity. Results are presented from start-up and adjustment operations of the system for testing of the hydrogen content of sodium, which uses a thick nickel membrane, as well as a test system with a thin nickel membrane in combination with a magnetic-discharge pump.

48612 (CONF-781001—P2, pp 17.1-17.18) **Main results of experiments with a major leak of water into sodium conducted in nineteen-tube models.** 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

The present report presents the main results of studies of effects that accompany major leaks of water into sodium under the conditions of 19-tube models in 1964—1967. The organization of the experiments and the methods of research are described. The dynamic and temperature phenomena in the sodium circuit and the vulnerability to damage of the tube bundle are discussed.

48613 (CONF-781001—P2, pp 18.1-18.28) **Acoustical methods of leak detection in sodium-water steam generators (a survey paper).** Afanas'ev, V.A.; Sokolov, V.M. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

The results of preliminary studies aimed at determining the feasibility of leak detection in a sodium-water steam generator by the acoustical method are presented. Results of studies of noise generation aimed at substantiating the selection of the frequencies used in the leak detection device are discussed. A qualitative analysis is given of the mechanisms of noise generation in a gas jet, and some experimental findings are presented.

48614 (CONF-781001—P2, pp 19.1-19.14) **Report on the results of analysis of emergency large leak modes in the steam generators of the BN-350 installation.** 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

This report briefly outlines basic results of analysis of emergency processes in the steam generator of the BN-350 reactor, resulting from large leaks of water into the sodium loop. A description is presented of the steam generator of the BN-350, and the characteristics of its emergency protection system are described.

48615 (CONF-781001—P2, pp 20.1-20.6) **Research program on an acoustical method of leak detection in sodium-water steam generators for 1978—1979.** 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

Bench tests on the characteristics of acoustic noise during a steam and gas leak into sodium are described. Tests using a model of the BN-600 steam generator are also described. Tests planned for the BOR-60 modular steam generator are mentioned.

48616 (CONF-790363—5) **Design considerations for CRBRP primary piping system operating at elevated temperatures.** Mello, R.M. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). 1979. Contract EY-76-C-15-2395. 18p. AT.

From US Japan specialist meeting on high temperature piping design and analysis; Pittsburgh, PA, USA (26 Mar 1979).

The heat transport system sodium piping for the Clinch River Breeder Reactor Plant (CRBRP) within the reactor containment building must withstand high temperatures for long periods of time. Each phase of the mechanical design process of the piping system is influenced by elevated temperature considerations which include material thermal creep effects, ratchetting caused by rapid temperature transients and stress relaxation, and material degradation effects. This requires that careful attention be given to through-wall temperature gradients and time-dependent material behavior in the design and analysis process. The description of the structural design philosophy and approaches taken to design the CRBRP piping operating in a high temperature environment are presented. In addition, the resulting design of the heat transport system piping is discussed along with the special features that resulted from the elevated temperature considerations.

48617 (CONF-790370—1) **Study of structural attachments of a pool type LMFBR vessel through seismic analysis of a simplified three dimensional finite element model.** Ahmed, H.; Ma, D. (Argonne National Lab., IL (USA)). 1979. Contract W-31-109-ENG-38. 15p. Dep. NTIS, PC A02/MF A01.

From 5. international conference on structural mechanics in reactor technology; Berlin, F.R. Germany (20 Mar 1979).

A simplified three dimensional finite element model of a pool type LMFBR in conjunction with the computer program ANSYS is developed and scoping results of seismic analysis are produced. Through this study various structural attachments of a pool type LMFBR like the reactor vessel skirt support, the pump support and reactor shell-support structure interfaces are studied. This study also provides some useful results on equivalent viscous damping approach and some improvements to the treatment of equivalent viscous damping are recommended. This study also sets forth pertinent guidelines for detailed three dimensional finite element seismic analysis of pool type LMFBR (to be published in a separate paper).

48618 (CONF-790808—1) **Testing of the CRBRP Direct Heat Removal Service in a 1/21 scale model.** Novendstern, E.H.; Marinkovich, P.S. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). Aug 1979. Contract EY-76-C-15-2395. 17p. Dep. NTIS, PC A02/MF A01.

From 18. ASME national heat transfer conference; San Diego, CA, USA (Aug 1979).

The Direct Heat Removal Service (DHRS) of the Clinch River Breeder Reactor Plant provides an alternative means of cooling of the core in the extremely unlikely event that both the normal and auxiliary heat paths are not available. The hot sodium is taken from the outlet plenum, cooled and returned into the outlet plenum at a different location; this sodium is mixed in the outlet plenum and pumped through the primary loops into the reactor core to remove the decay heat. The hydraulic performance of the outlet plenum was evaluated with a test using a 1/21 scale outlet plenum feature model. The model hydraulically simulated the Upper Internals Structure and the sodium within the reactor vessel. The hydraulic characteristics were studied to determine the amount of mixing which occurs in the outlet plenum.

48619 (CONF-790808—13) **Comparison of numerical results with experimental data for single-phase natural convection in an experimental sodium loop.** Ribando, R.J. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 53p. Dep. NTIS, PC A04/MF A01.

From 18. ASME national heat transfer conference; San Diego, CA, USA (Aug 1979).

A comparison is made between computed results and experimental data for single-phase natural convection in an experimental sodium loop. The tests were conducted in the Thermal-Hydraulic

Out-of-Reactor Safety (THORS) Facility, an engineering-scale high temperature sodium facility at the Oak Ridge National Laboratory used for thermal-hydraulic testing of simulated LMFBR subassemblies at normal and off-normal operating conditions. Heat generation in the 19 pin assembly during these tests was typical of decay heat levels. Tests were conducted both with zero initial forced flow and with a small initial forced flow. The bypass line was closed in most tests, but open in one. The computer code used to analyze these tests [LONAC (LOw flow and NAtural Convection)] is an ORNL-developed, fast running, one-dimensional, single-phase finite difference model for simulating forced and free convection transients in the THORS loop.

48620 (COO—2245-17TR(Rev.1)) **Input parameters to codes which analyze LMFBR wire wrapped bundles. Revision 1.** Wang, S.F.; Todreas, N.E. (Massachusetts Inst. of Tech., Cambridge (USA)). May 1979. Contract EY-76-S-02-2245. 57p. Dep. NTIS, PC A04/MF A01.

This report provides a current summary of recommended values of key input parameters required for ENERGY code analysis of LMFBR wire wrapped bundles. This data is based on the interpretation of experimental results from the MIT and other available laboratory programs.

48621 (COO—2245-68TR) **Multicell slug flow heat transfer analysis of finite LMFBR bundles.** Yeung, M.K.; Wolf, L. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). Dec 1978. Contract EY-76-S-02-2245. 511p. Dep. NTIS, PC A22/MF A01.

An analytical two-dimensional, multi-region, multi-cell technique has been developed for the thermal analysis of LMFBR rod bundles. Local temperature fields of various unit cells were obtained for 7, 19, and 37-rod bundles of different geometries and power distributions. The validity of the technique has been verified by its excellent agreement with the THTB calculational result. By comparing the calculated fully-developed circumferential clad temperature distribution with those of the experimental measurements, an axial correction factor has been derived to account for the entrance effect for practical considerations. Moreover, the knowledge of the local temperature field of the rod bundle leads to the determination of the effective mixing lengths L/sub ij/ for adjacent subchannels of various geometries. It was shown that the implementation of the accurately determined L/sub ij/ into COBRA-IIIC calculations has fairly significant effects on intersubchannel mixing. In addition, a scheme has been proposed to couple the 2-D distributed and lumped parameter calculation by COBRA-IIIC such that the entrance effect can be implanted into the distributed parameter analysis. The technique has demonstrated its applicability for a 7-rod bundle and the results of calculation were compared to those of three-dimensional analyses and experimental measurements.

48622 (COO—2245-69) **Coolant mixing in LMFBR rod bundles and outlet plenum mixing transients. Progress report, December 1,1978—February 28, 1979.** Todreas, N.E.; Golay, M.W.; Wolf, L. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). 1979. Contract EY-76-S-02-2245. 35p. Dep. NTIS, PC A03/MF A01.

Information is presented concerning coolant mixing in bundle geometry and subchannel geometry; outlet plenum flow mixing; and theoretical determination of local temperature fields in LMFBR fuel rod bundles.

48623 (EPRI-NP—1014(Vol.2)) **Pool-type LMFBR plant 1000 MWe Phase A-Extension-2 design. Part II: plant summary description. Final report.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Jun 1979. 214p. Dep. NTIS, PC A10/MF A01.

This plant summary description volume covers the integrated Phase A plant conceptual design as it exists at the completion of Extension 2 work. In most cases the designs described are the reference arrived at after due consideration of reasonable alternatives. For a few specific design features, however, the lack of system and component development test data obscures the choice between alternatives. For these features certain alternate options remain under active interest. Examples of design features in this category are the upper internals structure, the pool thermal barriers and thermal insulation, the IHX flow distribution, and the hot pool thermal-hydraulic design in general.

48624 (EPRI-NP—1014(Vol.3)) **Pool-type LMFBR plant 1000 MWe Phase A-Extension-2 design. Part III: reactor assembly, Sec. 1—2.5. Final report.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Jun 1979. 300p. Dep. NTIS, PC A13/MF A01.

The basic general arrangement of the reactor assembly for the General Electric Company's concept of a large pool type LMFBR plant was established in Phase A. EPRI design guidelines issued early in that phase specified fundamental plant features and requirements. New arrangement drawings were prepared for Phase A Extension 1 and are contained in the Extension 1 report. The overall size and basic configuration of the reactor assembly is unchanged from Phase A. The Phase A Extension 2 work on the general arrangement is a progression from Extension 1. Prominent modifications are shown and described, and design uncertainties defined.

48625 (EPRI-NP—1014(Vol.4)) **Pool-type LMFBR plant 1000 MWe Phase A-Extension-2 design. Part III: reactor assembly, Sec. 2-6—Appendix IIIB. Final report.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Jun 1979. 484p. Dep. NTIS, PC A21/MF A01.

The response to thermal striping and shock was determined for the upper internals structure. The components analyzed are identified and include (1) PRACS, (2) Fuel Transfer Tube, (3) Cold Trap, (4) Reactor Thermal Barrier, (5) Pump Thermal Barrier, (6) Horizontal Thermal Barrier, (7) IHX Upper Flow Shroud, (8) IHX Flow Shroud Inlet Region, (9) IHX External Cylinder, (10) Pump Inlet Nozzle, (11) Pump Exhaust Pipe, (12) Vessel Bottom Head, (13) Lower Core Support Structure, (14) Redundant Core Support, (15) Thermal Barrier Exits, and (16) Neutron Monitor Guide Tube.

48626 (EPRI-NP—1014(Vol.5)) **Pool-type LMFBR plant 1000 MWe Phase A-Extension-2 design. Part IV: reactor deck. Final report.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Jun 1979. 349p. Dep. NTIS, PC A15/MF A01.

The reactor roof or deck is a dominating structure in the pool reactor configuration; in addition to closing off the top of the reactor and providing access to the core for refueling (as it does also in the loop configuration) it also encloses and supports the entire primary coolant system including all major components such as pumps, IHXs, cold traps and instrumentation. Because of the absence of a suitable existing design basis in the United States for a large pool-concept design, the objective of the design effort was to establish feasibility through an intensive review of the many possible structural, insulation, cooling and shielding arrangements. The design effort considered construction, in-service inspection, response to non-routine conditions and influence on the pump and IHX configurations.

48627 (EPRI-NP—1014(Vol.6)) **Pool-type LMFBR plant 1000 MWe Phase A-Extension-2 design. Part V: heat transport systems. Final report.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Jun 1979. 524p. Dep. NTIS, PC A22/MF A01.

The heat transport systems carry heat from the reactor to the IHXs and from the IHXs to the steam generators. The major components in the primary heat transport system are the primary sodium pumps and IHXs, and the major components in the intermediate heat transport system are the intermediate sodium pumps and steam generators. The history and evolution of the pool reactor heat transport systems and components during previous study phases are summarized. In addition, highlights of the current study are summarized.

48628 (EPRI-NP—1014(Vol.7)) **Pool-type LMFBR plant 1000 MWe Phase A-Extension-2 design. Part VI: auxiliary systems; Part VII: plant control and instrumentation; Part VIII: seismic analysis. Final report.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Jun 1979. 364p. Dep. NTIS, PC A16/MF A01.

Several key NSSS auxiliary systems are needed to support the reactor and main heat transport systems. These auxiliary systems include fuel handling and storage, reactor auxiliary cooling, sodium purification, and cover gas processing and control. Work has been performed on each of these systems, either to develop appropriate system conceptual designs or to investigate problem areas and identify solutions. For the fuel handling and storage system, the reactor auxiliary cooling system (RACS), and the primary sodium purification system overall system designs have been generated. Conceptual and/or preliminary designs of major components have been generated. For the cover gas system, two key aspects have been studied. The cover gas pressure control performance requirements have been defined and a suitable control system identified. In addition gas leakage through the component-to-deck seals has been analyzed. Recommended seal types and configurations have been established.

48629 (EPRI-NP—1014(Vol.8)) **Pool-type LMFBR plant 1000 MWe Phase A-Extension-2 design. Part IX: constructability and fabricability; Part X: maintainability and inspectability; Part XI: safety. Final report.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Jun 1979. 330p. Dep. NTIS, PC A15/MF A01.

Information is presented concerning the construction and fabrication of the upper internals structure and thermal barriers, maintainability and inspectability of reactor components, and design basis accidents.

48630 (EPRI-NP—1014(Vol.9)) **Pool-type LMFBR plant 1000 MWe Phase A-Extension-2 design. Part XII: balance of plant—plant**

description. Final report. (Bechtel, Inc., San Francisco, CA (USA)). Jun 1979. 262p. Dep. NTIS, PC A12/MF A01.

The Bechtel-developed BOP conceptual design, which combines the work of Phase A and its extensions, is described. The overall plant, structures, and systems of a 1000 MWe (gross) LMFBR utilizing the pool concept and the saturated steam cycle adopted in Phase II, are described. Particular attention is directed to the description of features unique to the pool concept, and to incorporating the results of the special studies done in Phase A and Extensions 1 and 2.

48631 (EPRI-NP—1014(Vol.10)) **Pool-type LMFBR plant 1000 MWe Phase A-Extension-2 design. Part XII: appendices. Final report.** (Bechtel, Inc., San Francisco, CA (USA)). Jun 1979. 331p. Dep. NTIS, PC A15/MF A01.

Information presented includes system listing; an equipment list; piping class sheets; and a list of drawings.

48632 (EPRI-NP—1014(Vol.11)) **Pool-type LMFBR plant 1000 MWe Phase A-Extension-2 design. Part XIII: balance of plant - evaluation of pool-related areas. Final report.** (Bechtel, Inc., San Francisco, CA (USA)). Jun 1979. 525p. Dep. NTIS, PC A22/MF A01.

The supportive studies carried out in Phase A and its extensions investigated specific areas where practical solutions or procedures are considered essential prerequisites for subsequent design. Those areas identified for each phase of the work are summarized and described in detail along with significant conclusions reached.

48633 (ESG-DOE—13252) **Intermediate-size inducer pump program. Annual technical progress report, government fiscal year 1978.** (Atomics International Div., Canoga Park, CA (USA)). 26 Mar 1979. Contract EY-76-C-03-0824-020. 90p. AT.

The objective of the ISIP Development Program is to demonstrate the practical applicability of the Rockwell International inducer to large sodium pumps designed for reactor coolant service. The development of inducer pumps at Rockwell International started in the Rocketdyne Division with the development of high speed turbopumps for rocket engines. Since then inducer pumps have been applied successfully in the commercial area to water-jet propulsion systems for large high speed hydrofoil vessels. These commercial units require considerably greater life expectancy than those for space vehicles.

48634 (GEFR—00152) **Procedures for measuring bowing/expansion reactivity effects.** Fox, J.N. (General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.). Nov 1977. Contract EY-76-C-03-0893-023. 31p. AT.

Detailed analyses of CRBRP beginning-of-cycle first core were performed with the computer code CORTAC. The objective was to provide a sound technical basis for development of suitable reactivity measurement procedures. The resulting recommended procedures provide for the separate measurement of core restraint reactivity-related quantities during reactor startup and rise-to-power, radial reactivity feedback based on a transient which suppresses the Doppler and axial feedback contributions, and Doppler plus axial reactivity feedbacks based on a transient designed to suppress the radial reactivity feedback. For the model used, it was found that the transient reactivity feedbacks of coolant density, structural density, and cladding density were negligible compared with the fuel-related and radial reactivity feedbacks. The coolant density reactivity feedback was found to be less than 2% of the total, the structural density contribution essentially zero, and the cladding density reactivity feedback less than 1% of the total. During the startup and rise-to-power phase, the sodium density contribution is a little higher (< 3%) while the structural and cladding density reactivities remain about the same as in the transient case. Hence, the only components of reactivity feedback that are important relative to the reactivity measuring procedures contained herein are Doppler, axial, and radial feedback. In addition to providing total reactivity feedback as a function of power, the recommended reactivity measurement procedure during the startup and rise-to-power sequence provides for two key core restraint quantities that can be implied through the total reactivity measurements. The first quantity is the onset of the structurally determinate region; the second is the power level at which the Above-Core Load Plane (ACLP) gaps are effectively closed.

48635 (GEFR—00431) **Influence of decarburization on the 510°C (950°F) tensile and creep properties of thin section 2-1/4Cr—1Mo steel weldments.** Mandurrago, G.L.; Pizzo, P.P. (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Feb 1979. Contract EY-76-C-03-0893-031. 42p. AT.

The short-term tensile and creep properties of severely decarburized 2-1/4Cr—1Mo steel autogenous weldments at 510°C were determined by the properties of the base material. Limited deformation occurs within the autogenous weld region. Base metal properties will provide conservative design rules for CRBR. Microstructural damage, such as grain boundary void growth and/or triple point cracking, was not observed in either the Weld, HAZ, or Base Metal regions for conditions scoped in this study. Abnormal grain growth occurred within weld regions for the more extreme decarburization conditions. Abnormal grain growth was similarly observed in normalize and tempered (NT) specimens. Isothermal anneal and post weld heat treatment (IA + PWHT) specimens did not exhibit abnormal grain growth. Based on the limited kinetics data available, initiation of abnormal grain growth in decarburized regions will not occur in a design life of 30 years for temperature lower than 520°C (968°F).

48636 (GEFR—00432) **Materials characterization: study of decarburization influence on mechanical properties of CRBR steam generator tubing.** Pizzo, P.P. (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Feb 1979. Contract EY-76-C-03-0893-031. 45p. AT.

Tensile characterization tests at 510°C confirm that the thin section coupon specimens selected for the decarburization study exhibit analogous data trends to CRBR steam generator tubing. A real secondary size/geometry factor must be applied in interpreting steam generator tube properties from coupon data. Tensile ductility and ultimate tensile strength values require adjustment. Baseline creep data for tubular specimens selected for decarburization study correlate well with the Nuclear Systems Materials Handbook (NSMH) time-to-rupture and minimum creep rate correlations for annealed 2-1/4 Cr—1Mo steel. Thermal aging 1000 hours at 510°C reduces the tensile strength of 2-1/4 Cr—1Mo steel by approximately 17%. The effect is intrinsic. Further data are required to assess implications with respect to design. Scoping tests indicate that cold work enhances creep resistance of 2-1/4 Cr—1Mo steel while maintaining creep ductility. Fabrication induced cold work has significant impact on creep behavior, and a pretest stress relieving treatment must be incorporated in the decarburization study. Use of UTS as a correlation parameter for creep behavior is not supported by data. Although 510°C thermal aging reduces the UTS of 2-1/4 Cr—1Mo steel 17%, the creep properties before and after 510°C thermal aging are equivalent. Mechanical properties variations noted could not be correlated with carbide size and distribution. Thin film transmission electron microscopy techniques are required to provide structure/property correlation. Creep cavitation was observed at 510°C and at a stress of 130 MPa. Rupture time and minimum creep rate values were 11,253 hours and 1.6×10^{-3}% per hour. Further data are required to determine the nature of the cavities and to assess the impact of cavity formation on the resultant creep behavior.

48637 (GEFR—00439) **Bundle to duct interaction compression tests using large diameter pins.** Kaplan, S. (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). 19 Mar 1979. Contract EY-76-C-03-0893-031. 88p. AT.

Bundle compression testing was recently performed on large diameter pin bundles to expand the bundle compression test data base previously obtained using small diameter (0.230 inch) pins. The large diameter pin bundles used the carbide fuel pin size (0.370-inch diameter) and CRBR radial blanket pin size (0.506-inch diameter). The recent testing included pin ovalling measurements, data not obtained during the smaller diameter pin tests. This report summarizes the compression testing performed on pin bundles using the large diameter pins.

48638 (HEDL-SA—1399-FP) **Fabrication of ThO_2, UO_2, and PuO_2-UO_2 pellets.** Rasmussen, D.E.; Jentzen, W.R.; McCord, R.B. (Hanford Engineering Development Lab., Richland, WA (USA)). 1978. Contract EY-76-C-14-2170. 22p. (CONF-780545—10). Dep. NTIS, PC A02/MF A01.

From Meeting of the American Ceramic Society; Detroit, MI, USA (6 May 1978).

Portions of document are illegible.

Fabrication of ThO pellets for EBR-II irradiation testing and fabrication of UO_2 and PuO_2-UO_2 pellets for United Kingdom Prototype Fast Reactor (PFR) irradiation testing is discussed. Effect of process parameters on density and microstructure of pellets fabricated by the cold press and sinter technique is reviewed.

48639 (LA—7861-MS) **SPECTRA-IV, benchmark spectra based on LIB-IV.** Kidman, R.B. (Los Alamos Scientific Lab., NM (USA)). Jun 1979. Contract W-7405-ENG-36. 99p. Dep. NTIS, PC A05/MF A01.

Flux and adjoint spectra for each of the Cross Section Evaluation Working Group fast reactor benchmarks are numerically and graphically presented in this handbook. The spectra were computed using a 50-group cross-section library (LIB-IV) that was generated with the MINX processing code using ENDF/B-IV data. The graphical figures compare smooth interpolated curves for the central flux, edge flux, central adjoint, transport reaction rate, and original cross-section averaging weighting function.

48640 (LMEC—78-1) **Liquid Metal Engineering Center (LMEC). Annual technical progress report, January—December 1977.**

(Liquid Metal Engineering Center, Canoga Park, CA (USA)). 15 Apr 1978. Contract EY-76-C-03-0700. 350p. AT.

The immediate objective of the LMEC is to support the LMFBR program by providing sodium component and instrumentation test facilities. In the past, emphasis has been in support of the FFTF. At this time, more and more effort is being channeled into base technology programs in support of LMFBR requirements beyond FFTF. This report is divided into two parts, one dealing with testing initiated by external organizations, the other with LMEC-initiated programs required to improve the test facilities or to meet special test requirements. Only those projects considered to be of technical interest to the LMFBR community are reported.

48641 (PNL—2938) **COBRA-IV wire wrap data comparisons.** Donovan, T.E.; George, T.L.; Wheeler, C.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Feb 1979. Contract EY-76-C-06-1830. 42p. Dep. NTIS, PC A03/MF A01.

Thermal hydraulic analyses of hexagonally packed wire-wrapped fuel assemblies are complicated by the induced crossflow between adjacent subchannels. The COBRA-IV computer code simultaneously solves the hydrodynamics and thermodynamics of fuel assemblies. The modifications and the results are presented which are predicted by the COBRA-IV calculation. Comparisons are made with data measured in five experimental models of a wire-wrapped fuel assembly.

48642 (RD-B-N—4254) **Report on the second specialists' meeting on reactor noise (SMORN II), Gatlinburg, Tennessee, September 19th-23rd 1977.** Greef, C.P. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1978. 19p. Dep. NTIS (US Sales Only), PC A03/MF A01.

The current state of power reactor noise analysis as presented at the Second Specialists' Meeting on Reactor Noise (SMORN II) is reviewed. Practical successes include the analysis of PWR core support barrel motions and BWR instrument tube vibrations, leading to better understanding of the Physical processes involved. Future applications to LMFBRs are being actively pursued, but more information is required, notably on background noise sources in operating reactors. Theoretical understanding is improving in a number of specific areas, but general fundamental progress is hampered by the multiplicity of potential noise sources in a reactor. Past attempts to automate noise analysis so that simplified information may be presented to the reactor operator have not been totally successful. This has resulted from an over-hasty application of the techniques before all of the factors involved in physical phenomena were fully appreciated.

48643 (TREE—1360) **Evaluation of roll-extruded alloy 718 tubes: seamless versus welded.** Smolik, G.R.; Flinn, J.E.; Korth, G.E. (Idaho National Engineering Lab., Idaho Falls (USA)). May 1979. Contract EY-76-C-07-1570. 77p. AT.

Large-diameter tubes of Alloy 718 are required for the upper core chimneys for the Clinch River Breeder Reactor and other liquid metal fast breeder reactor applications. This investigation was performed to: (1) determine the feasibility of using welded cylindrical blanks for roll-extrusion stock and (2) obtain material property data from roll-extruded tubes. Seamless and welded tubes were roll extruded from a common material source, Alloy 718 reference heat. Recrystallization, tensile, creep-rupture and fatigue behavior were determined for both tubes. Effects of solution anneal temperature upon mechanical properties of the seamless tube were checked. The effect of orientation upon selected properties of both the seamless and welded tubes was also examined. Finally, tensile properties of the roll-extruded tubes were compared with AMS specification requirements and data for cylindrical products formed by other processes.

48644 (WARD-AD—3045-8) **Microstructural analysis of factors affecting void growth and solute segregation in neutron irradiated Fe—Cr—Ni experimental alloys for breeder reactor.** Baron, M.; Chang, A.L.; Chickering, R.W.; Wood, S.; Bleiberg, M.L. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). May 1979. Contract AMO2-76CH94000. 63p. AT.

The role of gamma prime particles on swelling was complex. They did not appear to serve as linear annealing sinks at which interstitial vacancy recombination takes place. They appeared to serve as solute storage and retrieval reservoirs which kept the concentration of solute in dynamic solution at a level higher than the solubility limit in equilibrium. Their effect on swelling could not be distinguished from compositional effects. Temperature dependencies of several possible mechanisms involving swelling inhibition due to solute additions were analyzed and compared with experimental results. The analysis suggested that the most appropriate swelling inhibiting mechanism associated with solute additions in these systems was the formation of solute rich atmospheres around dislocations which could lead to an effective reduction in dislocation preference for interstitial absorption. The temperature dependence of swelling, dislocation structure and γ' redistribution has been obtained in a neutron irradiated series of experimental steels with systematic chemical variations of both major and minor elements. By comparative analysis, the differential effects of several variables affecting swelling were investigated. Increased Ni content and corresponding reduction in iron decreased swelling. Ni was the only chemical element which appeared to suppress swelling uniformly over the entire temperature range. Mo, Ti+Al, and C+B+Si, while in solution, increased void number density and reduced average void growth rates. Si and Mo were effective swelling inhibitors in the temprature range $450^{\circ}C < T < 550^{\circ}C$. Outside this temperature range, Si and Mo additions could actually lead to increased swelling due to phase instabilities.

48645 **Hydrogen consentration meter utilizing a diffusion tube composed of 2 1/4 Cr-1 Mo steel and a sleeve of nickel.** Roy, P.; Sandusky, D.W; Hartle, R.T. (to Dept. of Energy). US Patent 4,143,316. 6 Mar 1979. Filed date 7 Sep 1977. 4p.
PAT-APPL-831,191.

A diffusion tube hydrogen meter for improving the sensitivity and response time for the measurement of hydrogen in liquid sodium is described. The improved hydrogen meter has a composite membrane composed of pure nickel sleeve fitted, for example, over a 2 1/4 Cr-1 Mo steel or niobium diffusion tube. Since the hydrogen permeation rate through 2 1/4 Cr-1 Mo steels is a factor of four higher than pure nickel, and the permeation rate of hydrogen through niobium is two orders of magnitude greater than the 2 1/4 Cr-1 Mo steel, this results in a decrease in response time and an increase in the sensitivity.

48646 **Flow-induced vibration scale model test of the CRBR instrument post.** Mulcahy, T.M.; Yeh, T.T.; Lawrence, W.P. (Argonne National Lab., IL). pp 59-66 of Fluid structure interaction phenomena in pressure vessel and piping systems. Au-Yang, M.K.; Brown, S.J. Jr. (eds.). New York, NY; American Society of Mechanical Engineers (1977).

From Winter annual meeting of the American Society of Mechanical Engineers; Atlanta, GA, USA (27 Nov 1977).

The analysis is presented for the Clinch River Breeder Reactor Instrument Post which has a finned rocket-like geometry with high potential for excitation. Correlated shedding of vortices from the trailing edge of plates in smooth, parallel flow is well documented. The basis of the excitation mechanism is discussed as well as scaling criteria and distortions, model construction and instrumentation, and selected results. No indication of correlated vortex shedding was observed in the response.

48647 **Numerical fluid-structure interaction analysis of piping systems.** A-Moneim, M.T. (Argonne National Lab., IL). pp 107-121 of Fluid structure interaction phenomena in pressure vessel and piping systems. Au-Yang, M.K.; Brown, S.J. Jr. (eds.). New York, NY; American Society of Mechanical Engineers (1977).

From Winter annual meeting of the American Society of Mechanical Engineers; Atlanta, GA, USA (27 Nov 1977).

A computer code for transient two-dimensional coupled hydrodynamic-structural response analysis of piping systems under the effect of internally travelling pressure pulses is described. Two dimensional hydrodynamic models for straight pipes, elbows, generalized piping component, tee branching junctions, and surge tanks are included and coupled together to form a general piping system that can be subjected to simultaneous pressure pulses of the form P(t). Options are provided in the generalized piping component; namely, interior rigid wall simulation, nine different exterior wall configurations, and heat exchanger tube bundle effects. Thus, it can be used in modelling of valves, pipe flow area changes and heat exchangers.

REGULATION AND LICENSING

48648 (DOE/TIC—10132) **Review and analysis of Unusual Occurrence Reports, 1978.** (Oak Ridge National Lab., TN (USA)). 1978. Contract W-7405-ENG-26. 48p. Dep. NTIS, PC A03/MF A01.

This report presents an index and analysis of final Unusual Occurrence Reports (UORs) received by the Nuclear Standards Office (NSO) during 1978. UORs covered by this report are those submitted by DOE-NPD and RRT contractors and laboratories in accordance with RDT standard F 1-3T, Preparation of Unusual Occurrence Reports. The bulk of the report consists of a list of occurrences by contractor and facility, a list of occurrences by accession number (AN) assigned by the NSO, and a key-word-in-context (KWIC) index of the occurrences. Tables are presented that show the frequency of broad categories of occurrences during the period; the types of equipment or systems involved in those incidents; and the factors responsible for them.

48649 (NUREG—0020(Vol.3)(No.6)) **Licensed operating reactors. Operating units status report, data as of 5-31-79.** (Nuclear Regulatory Commission, Washington, DC (USA)). Jun 1979. 169p. NTIS $10.00.

This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices and IE Headquarters; and the third section is an appendix containing comparative statistics of US nuclear/fossil capacity, identification of nuclear power plants within regional Electric Reliability Councils, the relative status of US nuclear electric production by state and other information.

ECONOMICS

FUEL CYCLE

48650 Dynamic multi-criteria analysis of spent-nuclear-fuel alternatives. Langham, R.W. II. Blacksburg, VA; Virginia Polytechnic Inst. and State Univ. (1978). 310p. University Microfilms Order No. 79-10,714.

Thesis (Ph. D.).

A generalized multiple-objective research and development (R and D) capital budgeting model incorporating production-allocation decisions is developed for the analysis of the spent-nuclear-fuel management problem. The generalized model is decomposed into two subproblems. First is a multiple-objective R and D capital budgeting problem and second is a multiple-objective fuel allocation problem. Goal programming is selected as an appropriate modeling technique for both generic models. The spent-nuclear-fuel-allocation problem is further decomposed into a dynamic program with a goal program at each stage. The objectives are to allocate R and D funds to process or technology development and to allocate spent fuel to certain alternatives so as to minimize the weighted and prioritized vector cost. With regard to the objectives of nonproliferation and nondiversion, occupational and population exposure, uranium resource conservation, and fuel cycle economics, the major conclusion is to use the spent fuel for further energy production, preferably via a combination of extended burnup and recycle alternatives.

NUCLEAR REACTOR TECHNOLOGY

THEORY AND CALCULATION

REFER ALSO TO CITATION(S) 48158

48651 (IEA—494) Numerical solutions of two-media problems in two-group neutron transport theory. Ishiguro, Y.; Garcia, R.D.M. (Instituto de Energia Atomica, Sao Paulo (Brazil). Div. de Engenharia Nuclear). Jan 1978. 49p. Dep. NTIS (US Sales Only), PC A04/MF A01.

Three problems involving two media in plane geometry are solved numerically in two-group neutron transport theory for isotropic scattering: two slabs with an incident flux, the critical problem for reflected slab reactors, and the cell problem. Each problem is reduced to a set of regular integral equations for the coefficients of the Case expansions an solved iteratively. Numerical results are reported for all problems.

48652 (RISO-M—2122) AFG-MONSU. A program for calculating axial heterogeneities in cylindrical pin cells. Neltrup, H.; Kirkegaard, P. (Risoe National Lab., Roskilde (Denmark)). Aug 1978. 33p. Dep. NTIS (US Sales Only), PC A03/MF A01.

The AGF-MONSU program complex is designed to calculate the flux in cylindrical fuel pin cells into which heterogeneities are introduced in a regular array. The theory - integral transport theory combined with Monte Carlo by help of a superposition principle - is described in some detail. Detailed derivation of the superposition principle as well as the formulas used in the DIT (Discrete Integral Transport) method is given in the appendices along with a description of the input structure of the AFG-MONSU program complex.

COMPONENTS AND ACCESSORIES

REFER ALSO TO CITATION(S) 48559, 48688, 48719, 48935

48653 (BGC-T—4290) Automatic ultrasonic testing of nuclear reactor pressure vessels. Model for relating the partial volume integrating method with equivalent reflector size. Waas, A. Translated from *Materialpruefung;* **19**: No. 9, 382-385(Sep 1977). 10p. British Gas, London, England.

The principle of the partial-volume integration method is described. The connection digit/cross-section of the circular disk reflector is presented graphically. This is followed by some remarks on the importance and measurement of the characteristic quantities, the development of a triangle approximation model and the establishment of a connection in a formula, between the partial volume integrating method value and the equivalent flaw size.

48654 (BNL-NUREG—25862) Nonlinear dynamic analysis of piping system using the PSEUDO force method. Prachuktam, S.; Bezler, P.; Hartzman, M. (Brookhaven National Lab., Upton, NY (USA); Nuclear Regulatory Commission, Washington, DC (USA)). 1979. Contract EY-76-C-02-0016. 11p. (CONF-790802—7). Dep. NTIS, PC A02/MF A01.

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The nonlinearities induced by piping constraints are taken into account as generalized pseudo forces on the right-hand side of the governing hydamic equilibrium equations. Then an existing linear elastic finite element piping code, IPIPE, was modified to permit application of the procedure. This option was inserted such that the analyses could be performed using either the direct integration method or via a modal superposition method, the Newmark-Beta integration procedure being employed in both methods. The modified code was proof tested against several problems taken from the literature or developed with the nonlinear dynamics code OSCIL. The problems included a simple pipe loop, cantilever beam, and lumped mass system subjected to pulsed and periodic forcing functions. The problems were selected to gage the overall accuracy of the method and to insure that it properly predicted the jump phenomena accociated with nonlinear systems. Implementation of the method was found to be straightforward with the simplest iteration procedure for the psuedo force vector sufficing. The results predicted with the method agreed in all important aspects with existing solutions as well as those generated with other methods. As with linear analyses, the modal superposition solution mode was found to be the most efficient, however, exhibiting slightly greater inaccuracies.

48655 Miniature water loop for boiler corrosion and deposition studies. Pritchard, A.M.; Peakall, K.A.; Smart, E. (UKAEA, Harwell. Atomic Energy Research Establishment). pp 139-146 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

A miniature boiler loop is described in which mass flow and heat transfer rates and water qualities similar to those in modern high pressure boilers are reproduced. The results of tests in which NaCl or NaOH labelled with ^{24}Na or ^{38}Cl was injected to give concentrations in a Sanicro 31 test section in the range 20-80 $\mu g.kg^{-1}$ with pressure of 18 MNm^{-2}, a mass flow of 2000 $kg.m^{-2}.sec^{-1}$ and a heat flux of 790 KWm^{-2}, are presented. The behaviour under these conditions of $Fe(OH)_2$, labelled with ^{59}Fe and injected to give 4 p.p.m. Fe, is also described.

48656 (UCRL—52614) Elastic-plastic analyses for seismic reserve capacity in power plant braced frames. Nelson, T.A.; Murray, R.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 4 Oct 1978. Contract W-7405-ENG-48. 90p. Dep. NTIS, PC E05/MF A01.

The Lawrence Livermore Laboratory was asked by the U.S. Nuclear Regulatory Commission to investigate the inelastic behavior of a representative noncategory I structure and determine the amount of reserve seismic capacity that is available beyond elastic design levels. Elastic and elastic-plastic seismic analyses were conducted on a braced steel frame using eight time-history records. In addition, two spectra were ultimate capacity, the reserve strength of the frame was determined. In order to ensure operability, a frame model incorporating a piping system was subjected to the above seismic loadings using elastic analyses. It was found that the piping system components controlled the seismic capacity of the combined structure. The average results show a reserve capacity of 2.6 times the seismic design level.

48657 Study on possibility of application of redox potential measurements to behaviour of metal-water system in watercooled power plant circuits. Binecchio, M.L. (ENEL, Piacenza (Italy). Central Labs.); Carassiti, F.; Cigna, R.; Sturla, G. pp 171-174 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

Recent theories and a number of observations carried out in Italy by ENEL, concerning power plants, led to the conclusion that in some cases redox potential measurements may clarify the evolution in time of deposition and redissolution phenomena that occur at the metal-water interface. A discussion is made of the possible application to the determination of the electrochemical parameters of the metal-oxide-liquid system.

48658 Radiation enhancement of zircaloy corrosion in boiling water systems: a study of simulated radiation chemical kinetics. Burns, W.G.; Moore, P.B. (UKAEA, Harwell. Atomic Energy Research Establishment). pp 281-289 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

The FACSIMILE computer programme designed to simulate homogeneous chemical kinetics in a monophase system undergoing unidimensional flow, has been applied to the radiation chemistry of the water component of the coolant in a fuel channel of a pressure tube type BWR. Predictions were compared (a) with observations of the amounts of radiolytic gases produced (hydrogen and oxygen) and (b) with experimental results on the suppression of radiolytic oxygen by hydrogen present in solution at the start of flow. It was found that radiolytic gas yields were very dependent on the ratio of gas stripping and re-solution rate constants, and this ratio and the rate-constant for the thermal decomposition of hydrogen peroxide were adjusted to give agreement with observations (a) and (b) for the Winfrith SGHWR. Increase of steam quality gave rise to a predicted increase, and increase of dose-rate to a predicted decrease in gas yields (in terms of mass evolved per unit energy input). The HO_2 concentration, (believed to influence the radiation enhanced corrosion rate) was predicted to have a dependence on position which showed features corresponding with trends in the corrosion rate profile of the fuel in a Winfrith SGHWR channel. The simulated HO_2 concentration was only slightly dependent on steam quality, falling slightly with increasing quality, and its value per unit dose-rate decreased somewhat with increasing dose-rate. The simulated effect of hydrogen present at the start of flow in concentrations of ca 2 STP cm^3kg^{-1}, in addition to reducing the outlet oxygen concentration by a factor ca 10 also decreased the levels of $[HO_2]$ by factors of 4 to 10, suggesting the possibility of a large reduction in the radiation enhanced corrosion rate. Such an addition could be made by using electrolytic hydrogen, the concomitant oxygen being used for recombination at the flow exit without large increases in the off-gas plant.

48659 Boiler corrosion and the requirement for feed- and boiler-water chemical control in nuclear steam generators. Garnsey, R. (Central Electricity Research Labs., Leatherhead (UK)). pp 1-10 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

High capital cost, low fuel cost and the difficulty of access and repair result in very high economic penalties for failures of nuclear steam generators. Design constraints on nuclear boilers mean that they often contain features which are undesirable from the corrosion and deposition viewpoint. These differences dictate a much more vigorous control of steam circuit water chemistry and in some cases a different philosophy from that which has been practised on conventional stations. They have also prompted much more detailed investigations of the mechanisms by which feedwater salts concentrate and produce corrosive conditions. The implications of this for feed-water control and management are discussed.

48660 Condensate polishing: a new approach. Emmett, J.R. (Clarke Chapman - John Thompson Ltd., Gateshead (UK)). pp 25-32 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

The selectivity coefficients for ion exchange resins used in condensate polishing have been determined at concentrations pertinent for the process. Calculations based on these determinations show that the process is capable of producing exceedingly high purity water and will be able to meet future demands with respect to quality. Factors which interfere with the attainment of this high standard are reviewed. It is considered that contacting of anion resin with regenerant acid is a major contributing factor to loss of treated water quality which has, in the past, been overlooked.

48661 Activated corrosion products released by thermal shocks in reactor primary circuits. Rozenberg, J.; Alvy, J.C.; Kahan, H.; Robert, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service d'Analyses et d'Etudes en Chimie Nucleaire et Isotopique). pp 133-138 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

The releases of radioactive corrosion product species during controlled cooling down experiments have been found to be systematic for all nuclides analysed in the water of the in-pile loop IRENE. These releases have not been generally associated with corresponding increase of the quantities of chemical solubles. The activities seemed to release mostly in a particulate or colloidal form. These findings have been checked through thermal shocks followed by recovery of deposited iron oxides labelled with Fe-59 in the out-of-pile pressurized water loop MAGGAN.

48662 Provisions for the chemical control of feedwater to nuclear systems. Stallard, M.D.; Tonge, D. (Central Electricity Generating Board, Barnwood (UK). Generation Development and Construction Div.). pp 11-17 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

Successful chemical control of the feedwater to nuclear systems is very dependent on the adequacy of the installed provisions for the monitoring and control of important chemical parameters. This paper identifies and discusses those measures which the CEGB consider can be taken in the context of optimising these provisions together with the factors which influence them.

48663 Shutdown radiation level and man-rem control for water cooled reactors. Cripps, S.J.; Regan, J.D. (Nuclear Power Co. (Risley) Ltd. (UK)). pp 215-224 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

The importance of controlling the formation and subsequent deposition of active corrosion products (crud) is highlighted as a method of reducing occupational exposure. A semi-empirical model is described and used to predict the effectiveness of various methods of crud control. The relative merits of reactor coolant clean-up techniques including ion-exchange and electromagnetic filtration are assessed in terms of man-rem savings and associated cost penalties.

48664 (HSE-Trans—7302) Quality and nuclear boilers. Cante, C. Translated from *Rev. Gen. Nucl.;* No. 4, 335-338(Jul-Aug 1976). 12p. Health and Safety Executive, London, England.

The design and manufacture of the components, assembly, erection and tests, these different stages in the making of a nuclear boiler are carried out according to very accurately defined techniques and organization. From the technical viewpoint, it is shown how standard practice, experience, tests, the respect of codes and standard specifications contribute to the quality of achievement. The organizing of the assurance of quality is exposed by more particularly bringing to mind an American text which sets forth a certain number of principles widely applied beyond the frontiers of the United States.

FUEL ELEMENTS

REFER ALSO TO CITATION(S) 48947

48665 (IBK—1427) Sertification of fuel cladding and grids materials in out of pile conditions. Stefanovic, V.M.; Jovasevic, J.V.; Jovasevic, V.D.; Spasic, Z.L. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). 1977. vp. (In Serbian). Dep. NTIS (US Sales Only), PC A04/MF A01.

The basic standard specifications for fuel rod cladding and bundle materials, are selected. In this paper the standard specifications of material for Zircaloy and plugs and stainless steel springs of fuel rod cladding are presented. The material specification for a Zircaloy fuel bundle assembly Cgrids) is also given.

48666 (JAERI—1254) Critical sizes of light-water moderated UO_2 and PuO_2-UO_2 lattices. Tsuruta, H.; Kobayashi, I.; Suzuki, T.; Ohno, A.; Murakami, K. (Japan Atomic Energy Research Inst., Tokyo). Feb 1978. 38p. Dep. NTIS (US Sales Only), PC A03/MF A01.

Experimental critical sizes are presented for a total of about 250 lattices with 2.6 w/o UO_2 and 3.0 w/o PuO_2-natural UO_2 fuel rods. The moderator was H_2O and water-to-fuel volume ratios in the lattice cells ranged from 1.50 to 3.00 in the UO_2 lattices and from 2.42 to 5.55 in the PuO_2-UO_2 lattices. The critical sizes were determined with the number of the fuel rods and a water level which were required to make the lattice critical in the shape of a rectangular parallelepiped over the temperature range from room temperature to 80°C. Reactivity variations of the PuO_2-UO_2 lattices due to decaying of ^{241}Pu to ^{241}Am were traced during 3 years. Some critical sizes of the UO_2 and PuO_2-UO_2 lattices with a water gap and of the UO_2 lattices with liquid poison in the moderator are also reported. Some physics parameters, such as the temperature coefficient of reactivity, the water-level worth, the reflector saving, the ratio between a migration area and an infinite multiplication factor and the critical buckling, are shown in relation to the critical sizes of the unperturbed lattices without the water gap and liquid poison.

48667 Experimental and theoretical investigation of coupled vibration of tube banks. Chen, S.S.; Jendrzejczyk, J.A.; Wambsganss, M.W. (Argonne National Lab., IL). pp 19-36 of Fluid structure interaction phenomena in pressure vessel and piping systems. Au-

Yang, M.K.; Brown, S.J. Jr. (eds.). New York, NY; American Society of Mechanical Engineers (1977).

From Winter annual meeting of the American Society of Mechanical Engineers; Atlanta, GA, USA (27 Nov 1977).

A tube assembly consisting of four cantilevered tubes is tested under five different conditions: (1) fully submerged in an "infinite" water medium; (2) partially submerged in water; (3) near a flat wall; (4) contained in a circular cylinder; and (5) submerged in a liquid of high viscosity. Natural frequencies, mode shapes, and steady-state responses are measured. An analysis is also made for each test with the exception of the last case. The experimental data and analytical results are found to be in good agreement.

CONTROL SYSTEMS

48668 (HEDL-SA—1690-FP) **Fast reactor neutron absorber materials.** Mahagin, D.E. (Hanford Engineering Development Lab., Richland, WA (USA)). Apr 1979. Contract EY-76-C-14-2170. 17p. (CONF-790420—16). Dep. NTIS, PC A02/MF A01.

From International symposium on ceramics in nuclear waste management; Cincinnati, OH, USA (30 Apr 1979).

In a fast reactor, nuclear properties limit the number of materials that can be considered for use as neutron absorbers. On a worldwide basis the leading candidates are boron carbide, europium sesquioxide, and europium hexaboride. The performance of these materials is discussed with regard to current and future requirements.

48669 (ZfK—354) **Experimental investigation of flow-induced control element movements by means of noise analysis technique.** Grunwald, G.; Liewers, P.; Schumann, P.; Weiss, F.P. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Mar 1978. 9p. Dep. NTIS (US Sales Only), PC A02/MF A01.

Experiments at an air flow model of the control element channel which have clarified the reasons for these amplitude discrepancies for the most part are described.

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 48535, 48536, 48710, 49283

SITING

REFER ALSO TO CITATION(S) 49292

48670 **Geogolical study of the underground siting of nuclear power plants.** Sacramento, CA; California Division of Mines and Geology (1978). 133p. (NP—23820).

This study is intended as a compilation of background information useful in assessing the feasibility of placing nuclear power facilities underground in California. Various kinds of gologic and other information were assembled, and maps were prepared to present this information graphically, on a state-wide basis. Transparent overlays of these maps were made to facilitate combining and comparing the data from each of the individual maps, and composites of certain of the overlays were made to summarize significant data in various ways. An appendix includes resumes of some of the characteristics of the various rock units of the state, as these characteristics pertain to the suitability of the rock units for underground siting.

RADIOACTIVE EFFLUENTS

REFER ALSO TO CITATION(S) 49139

48671 (LTR—10-51) **Inhalation dosage determination resulting from BST failure and from release directly to the LOFT containment following L2-3 blowdown.** Schofield, R.S. (Idaho National Engineering Lab., Idaho Falls (USA)). 16 Jan 1979. Contract EY-76-C-07-1570. 12p. Dep. NTIS, PC A02/MF A01.

This LTR presents results obtained from analyses to scope potential radiological dosages following L2-3 blowdown. Two events were considered by these analyses: (1) inhalation dose at the site boundary assuming Blowdown Suppression Tank header failure and (2) inhalation dose at the one-mile fence following Blowdown Suppression Tank integrity failure.

48672 (NUREG/CR—0781) **SKYSINE-II procedure: calculation of the effects of structure design on neutron, primary gamma-ray and secondary gamma-ray dose rates in air.** Lampley, C.M. (Radiation Research Associates, Inc., Fort Worth, TX (USA)). Jan 1979. 158p. (RRA-T—7901). NTIS, PC A08/MF A01.

An updated version of the SKYSHINE Monte Carlo procedure has been developed. The new computer code, SKYSHINE-II, provides a substantial increase in versatility in that the program possesses the ability to address three types of point-isotropic radiation sources: (1) primary gamma rays, (2) neutrons, and (3) secondary gamma rays. In addition, the emitted radiation may now be characterized by an energy emission spectrum product of a new energy-dependent atmospheric transmission data base developed by Radiation Research Associates, Inc. for each of the three source types described above. Most of the computational options present in the original program have been retained in the new version. Hence, the SKYSHINE-II computer code provides a versatile and viable tool for the analysis of the radiation environment in the vicinity of a building structure containing radiation sources, situated within the confines of a nuclear power plant. This report describes many of the calculational methods employed within the SKYSHINE-II program. A brief description of the new data base is included. Utilization instructions for the program are provided for operation of the SKYSHINE-II code on the Brookhaven National Laboratory Central Scientific Computing Facility. A listing of the source decks, block data routines, and the new atmospheric transmission data base are provided in the appendices of the report.

CHEMICAL AND THERMAL EFFLUENTS

REFER ALSO TO CITATION(S) 49273

RESEARCH, TEST, AND EXPERIMENTAL REACTORS

REFER ALSO TO CITATION(S) 48671, 48686, 48687, 48691, 48917

48673 **Radiolytic yields in water reactor system and influence of dissolved hydrogen and nitrogen.** Dolle, L.; Rozenberg, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). pp 291-297 of Water chemistry of nuclear reactor systems. London; Thomas Telford for BNES (1978).

From International conference on chemistry of nuclear reactor systems; Bournemout, UK (24 Oct 1977).

Hydrogen or hydrogen peroxide formation and disappearance rates have been measured in cooling systems of swimming pool reactors as a function of the power level. The initial yield of the radiolytic decomposition of water is independent of the reactor power and equals the theoretical composite yield derivated from the separate contributions of gamma flux and fast neutrons. At a constant power level of the reactor, the molecular products are formed with a decreasing yield and reach a stationary concentration. This yield depends only on the difference between the stationary and the instantaneous values of their concentrations. A linear regression between the stationary value of the hydrogen concentration and the reactor power is also observed. The relation in the case of the OSIRIS reactor at a power level of 70 MWt is: (H$_2$)sub(cm)3sub(.1)-1 = 0.16 Psub(MWt) + 2.5 (+ - 2). No appreciable conversion of dissolved nitrogen under ionizing radiation could be observed, confirming that nitric acid or ammonia formation takes place only in the existing gaseous phase. The non-detrimental effect of dissolved nitrogen was then demonstrated by varying the nitrogen concentration in the helium cover gas of the out-of-flux expansion vessel of a heavy water reactor.

48674 (ANL—79-14) **Waste production and management at EBR-II.** Witbeck, L.C.; Fryer, R.M. (Argonne National Lab., IL (USA)). Apr 1979. Contract W-31-109-ENG-38. 43p. AT.

This report surveys waste production rates and disposal practices at EBR-II, a small-scale liquid-metal fast breeder reactor, for the past decade. Normal airborne wastes have been reduced by switching to low-sulfur fuel oil in auxiliary boilers and by converting to use of reactor steam for part of the plant space heating. Atmospheric releases of gaseous radioactive wastes initially increased during the implementation of programs for testing reactor fuels to and beyond cladding breach; but the effluent rates have now been reduced to far below permissible limits by use of a cryogenic distillation column. EBR-II's small production of liquid radioactive waste is handled by evaporation, followed by disposal of the evaporator sludge as solid waste. Liquid-waste releases meet all applicable state and federal standards. Solid wastes are sent to two storage/disposal areas - one of which is reserved primarily for storage of materials containing sodium, pending development of a facility for disposal of the sodium. In overall waste emission, EBR-II compares very favorably with commercial light-water reactors.

48675 (CONF-781001—P2, pp 5.1-5.22) **Study of the once-through serpentine steam generator in the BOR-60 experimental nuclear powerplant.** Kondrat'ev, V.I.; Titov, V.F.; Bai, V.F. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

Results are presented from testing of a once-through serpentine steam generator which had operated under load for 18,000 hours in the BOR-60 installation. Its basic operational, steady-state, transient and emergency modes are described, as well as the water chemistry determined in the process of testing. The results of corrosion-mechanical studies of the coils of the steam generator, made of 1KH2M steel, are presented for testing after 4,000, 6,200, 8,400 and 18,000 hours of reactor operation. The nature, composition and thickness of corrosion products in the evaporated and steam-superheating sections are indicated. The degree of damage to the tubes of the coils resulting from pitting corrosion, decarburization and changes in the mechanical properties of the steel in the process of use is estimated.

48676 (CONF-781001—P2, pp 14.1-14.18) **Simulated and experimental studies of large leaks in micromodular steam generators.** Chernobrovkin, Iu.V.; Kondrat'ev, V.I.; Smirnov, A.M.; Bukhteev, I.S.; Tomesh, V.; Matal, O. 1978.

From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

A program of experimental work is presented for the study of small and large leaks of water into the sodium in the micromodular steam generator of the BOR-60 reactor. Requirements are established as to the volume of information collected during experiments and the measurement systems required. The basic prerequisites for the method and programs for simulation of large-leak emergency are presented, with some results of leak simulation involving bursting of the entire cross section of one tube in the micromodular steam generator of the BOR-60.

48677 (CONF-790655—3) **Reactor vessel and core two-phase flow ultrasonic densitometer.** Arave, A.E. (Idaho National Engineering Lab., Idaho Falls (USA)). 1979. Contract EY-76-C-07-1570. 41p. Dep. NTIS, PC A03/MF A01.

From Colloquium on two-phase instrumentation; Idaho Falls, ID, USA (11 Jun 1979).

A local ultrasonic density (LUD) detector has been developed by EG and G Idaho, Inc., at the Idaho National Engineering Laboratory (INEL) for the Loss-of-Fluid Test (LOFT) reactor vessel and core two-phase flow density measurements. The principle of operating the sensor is the change in propagation time of a torsional ultrasonic wave in a metal transmission line as a function of the density of the surrounding media. A theoretical physics model is presented which represents the total propagation time as a function of the sensor modulus of elasticity and polar moment of inertia. Separate effects tests and two-phase flow tests have been conducted to characterize the detector. Tests show the detector can perform in a 343°C pressurized water reactor environment and measure the average density of the media surrounding the sensor.

48678 (CONF-790803—15) **Instrumentation for localized measurements in two-phase flow conditions.** Neff, G.G.; Averill, R.H.; Shurts, S.W. (Idaho National Engineering Lab., Idaho Falls (USA)). 1979. Contract EY-76-C-07-1570. 12p. Dep. NTIS, PC A02/MF A01.

From 14. intersociety energy conversion conference; Boston, MA, USA (5 Aug 1979).

Three types of instrumentation that have been developed by EG & G Idaho, Inc., and its predecessor, Aerojet Nuclear company, at the Idaho National Engineering Laboratory to investigate two-phase flow phenomenon in a nuclear reactor at the Loss-of-Fluid Test (LOFT) facility are discussed: (a) a combination drag disc-turbine transducer (DTT), (b) a multibeam nuclear hardened gamma densitometer system, and (c) a conductivity sensitive liquid level transducer (LLT). The DTT obtains data on the complex problem of two-phase flow conditions in the LOFT primary coolant system during a loss-os-coolant experiment (LOCE). The discussion of the DTT describes how a turbine, measuring coolant velocity, and a drag disc, measuring coolant momentum flux, can provide valuable mass flow data. The nuclear hardened gamma densitometer is used to obtain density and flow regime information for two-phase flow in the LOFT primary coolant system during a LOCE. The LLT is used to measure water and steam conditions within the LOFT reactor core during a LOCE. The LLT design and the type of data obtained are described.

48679 (CONF-790807—1) **Power distribution and control element reactivity changes in Advanced Test Reactor due to beryllium reflector redesign.** Gregory, W.D.; Zimmermann, W.L. (Idaho National Engineering Lab., Idaho Falls (USA)). 1979. Contract EY-76-C-07-1570. 5p. Dep. NTIS, PC A02/MF A01.

From Topical conference on reactor operating experience; Arlington, TX, USA (5 Aug 1979).

A redesigned beryllium reflector has been installed in the Advanced Test Reactor (ATR) at the Idaho National Engineering Laboratory. The main feature of the redesigned reflector was the introduction of horizontal sawcuts at 13 different elevations immediately adjacent to the fuel region of the core. Two other significant core design changes were made at the same time: (1) the hafnium plates on the outer shim control cylinders were reduced in arc length from 134° to 122°, and (2) the inside diameter of the center flux trap baffle was reduced from 85.725 mm (3.375 in.) to 82.2325 mm (3.2375 in.) to increase the metal-to-water ratio in the center flux trap baffle region. Following installation of the redesigned components, zero power physics tests were made with a core of new fuel elements prior to resuming full power operation. The power distribution measurements were obtained in both the ATR and ATRC by irradiating U—Al flux wires in each of the forty fuel elements. The irradiated wires are counted for beta activity which is then converted to specific fission rate. The specific fission rate data are used to calculate point power densities and fuel element powers.

48680 (HEDL-SA—1676) **Practical considerations from construction of the FFTF pipe support system.** Hartsell, J.O. (Hanford Engineering Development Lab., Richland, WA (USA)). Apr 1979. Contract EY-76-C-14-2170. 30p. (CONF-790488—7). Dep. NTIS, PC A03/MF A01.

From 2. PEWG specialists - meeting; Richland, WA, USA (23 Apr 1979).

Late this year the FFTF is scheduled to initiate criticality and power operation, an event signifying complete resolution of construction problems and compliance with applicable requirements. One of the tasks accomplished to achieve this position was the conduct of cell completion walkthroughs, problem identification, and resolution. Heavily oriented toward the final verification of pipe supports, the cell completion process identified and resolved a series of problems not readily apparent during the detailed design phases of plant construction. It is the objective of this presentation to establish a degree of awareness of these types of problems and of the FFTF techniques employed in resolution. All of the problems depicted herein have been solved and the installations corrected.

48681 (HEDL-TME—75-96) **FTR HCM scale-model flow-induced vibration tests, Phases I and II. Final report.** Ryan, J.A.; Mahoney, J.J. (Hanford Engineering Development Lab., Richland, WA (USA)). Jun 1979. Contract EY-76-C-14-2170. 116p. AT.

The flow-induced vibrational characteristics of scaled Fast Flux Test Facility (FFTF) Fast Test Reactor (FTR) core internal and peripheral components were assessed under scaled and simulated FTR flow conditions in the Hydraulic Core Mockup (HCM). The HCM was an 0.285 geometric scale model of the FTR internals and, as such, was designed to model the vibrational and hydraulic characteristics of the FTR. Vibration tests were conducted with water simulating the coolant over the range of 36 to 110% scaled FTR design flow rates. Selected model internals were instrumented with accelerometers and their vibrational characteristics were measured and established for the range of flow rates. The measured dynamic response of the scaled FTR components exhibited neither abnormal nor anomalous flow rate dependent response. Component vibrational characteristics were adjudged acceptable in terms of FTR response.

48682 (IDO—1570-T12) **LOFT monthly progress report for May 1979.** (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1979. Contract EY-76-C-07-1570. 75p. Dep. NTIS, PC A04/MF A01.

LOFT personnel successfully performed the second nuclear experiment in the power ascension series, L2-3, on May 12 after several months of preparations. Satisfactory initial conditions were achieved, including a maximum linear heat generation rate of 39.4 kW/m. Core rewet, which occured early in the blowdown phase, influenced core thermal response. This was similar to the results of experiment L2-2. Costs through May continue to be less than budgeted, primarily as a result of material costs accrued but not costed, some necessary rescheduling, and cost savings not yet reflected in Change Control Board actions. Initial work to accelerate the Small Break Series with consequent deferral of the remaining Power Ascension Series experiments has begun.

48683 (Juel—1507) **Determination of reactivity of multiplying systems filled with spherical HTGR-fuel elements using kinetic methods with regard to the pulsed-neutron method.** Drueke, V. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Jun 1978. 134p. (In German). Dep. NTIS (US Sales Only), PC A07/MF A01.

Thesis.

At three critical or subcritical facilities - two of them filled with spherical HTGR-fuel elements - the reactivity is determined using kinetic methods. Besides the inverskinetic method the applicability of the pulsed-neutron method is investigated. The experimental results using the pulsed-neutron method are compared partly with the inverskinetic method and partly with diffusion-calculations. It is shown, that in the HTGR the space dependence of the reactivity in radial direction is not remarkable in spite of the 'kinetic distortion'; on the contrary in axial direction - the direction of the external neutron source - space dependent reactivity worths are measured. The results of the pulsed-neutron methods of Sjoestrand and Sim-

mons-King are rather good applicable in all configurations. For the method of Sjoestrand it is necessary to select the detector positions, whereas for Simmons-King the calculated life-time determines the results. Therefore it is proposed to compare calculated and measured decay constants of the prompt neutron field in future.

48684 (LA-UR—79-2037) **Developments in the LASL Fuel Pin Imaging System: PINEX-3A.** Lumpkin, A.H.; Berzins, G.J.; Cosimi, R.A.; O'Hare, T.E.; Davidson, J.R. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 11p. (CONF-790816—14). Dep. NTIS, PC A02/MF A01.

From International meeting on fast reactor safety technology; Seattle, WA, USA (19 Aug 1979).

The LASL Fuel Pin Imaging System was evaluated using a series of 10 TREAT transients, each of ~ 240-MW peak power. HEDL provided the fuel-ejection type capsule with annular fuel pellets. The pin visibility threshold was determined to be ~ 20-MW of TREAT power (~ 130 W/g), almost an order of magnitude improvement over our PINEX-2 threshold. The impact of changes in instrumentation, imaging apertures, and fluors that produced the improved sensitivity are reported. Results of a time-integrated imaging technique are also presented.

48685 (LTR—125-9) **LOFT CIS analysis 4"-WH-237-E inside containment penetration S-17B.** Nitzel, M.E. (Idaho National Engineering Lab., Idaho Falls (USA)). 30 Oct 1978. Contract EY-76-C-07-1570. vp. (RE-A—78-173). NTIS MFA01.

Portions of document are illegible.

The stress analysis performed on the 4"-WH-237-E piping system inside containment penetration S-17B is presented. Deadweight, thermal expansion, and seismic loads were considered. Results of this analysis show that the subject piping system will meet ASME Code, Section III, Class 2 requirements.

PROPULSION REACTORS

REFER ALSO TO CITATION(S) 48720, 48721

REACTOR SAFETY

REFER ALSO TO CITATION(S) 48648, 49139

48686 (BNL-NUREG—25493) **Analysis of the FFTF primary pipe rupture transients.** Perkins, K.R.; Bari, R.A.; Chen, L.C.; Albright, D.C. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 26p. (CONF-790816—6). Dep. NTIS, PC A03/MF A01.

From International meeting on fast reactor safety technology; Seattle, WA, USA (19 Aug 1979).

The response of the Fast Flux Test Facility (FFTF) to hypothetical ruptures of the high pressure primary piping has been analyzed using two LMFBR plant systems codes, namely IANUS and DEMO. Comparisons of the average channel temperatures predicted by the two codes show good agreement for identical transients. However, the hot channel temperatures predicted by DEMO are about 60K higher than the corresponding IANUS predictions for severe transients. This difference is attributed to the dynamic hot channel factors employed in DEMO which discount the thermal inertia of the duct walls for rapid transients. DEMO also predicts more severe transients for hot-leg ruptures in FFTF than previously reported analyses for the CRBR.

48687 (BNL-NUREG—25522) **Containment response to postulated ex-vessel core meltdown accidents in the fast flux test facility.** Pratt, W.T.; Gasser, R.D.; Marchese, A.R. (Brookhaven National Lab., Upton, NY (USA); Nuclear Regulatory Commission, Washington, DC (USA). Div. of Project Management). 1979. Contract EY-76-C-02-0016. 12p. (CONF-790816—1). Dep. NTIS, PC A02/MF A01.

From International meeting on fast reactor safety technology; Seattle, WA, USA (19 Aug 1979).

An evaluation of the containment response to ex-vessel core meltdown accidents in the Fast Flux Test Facility is discussed. Particular attention is given to the possibility of the molten fuel/steel mixture remaining in a molten form after entering the reactor cavity. For the molten pool configurations considered, significant H_2 concentrations were reached in the RCB before the reactor cavity floor was penetrated. The melt-front impacts the pressure transient, not through gas generation, but through penetration into the unlined subcavity resulting in an enhanced sodium-concrete reaction. Hence, if H_2 recombination is neglected, then steps would have to be taken to decrease the H_2 concentration before the RCB design ressure is reached.

48688 (BNL-NUREG—25844) **Response of a nonlinear system to various spectral excitation time decompositions.** Curreri, J.; Bezler, P.; Koplik, B.; Goradia, H. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 6p. (CONF-790802—10). Dep. NTIS, PC A02/MF A01.

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

This paper discusses the effects of different acceptable time histories that have been applied to a linear and a nonlinear system. The time histories have been obtained from a spectral description of an earthquake event. The nonlinear system is taken as a linear one to which a cubic hardening term has been added.

48689 (BNL-NUREG—25845) **Three-dimensional computer code for the nonlinear dynamic response of an HTGR core.** Subudhi, M.; Lasker, L.; Koplik, B.; Curreri, J.; Goradia, H. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 8p. (CONF-790802—8). Dep. NTIS, PC A02/MF A01.

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

A three-dimensional dynamic code has been developed to determine the nonlinear response of an HTGR core. The HTGR core consists of several thousands of hexagonal core blocks. These are arranged inlayers stacked together. Each layer contains many core blocks surrounded on their outer periphery by reflector blocks. The entire assembly is contained within a prestressed concrete reactor vessel. Gaps exist between adjacent blocks in any horizontal plane. Each core block in a given layer is connected to the blocks directly above and below it via three dowell pins. The present analystical study is directed towards an invesstigation of the nonlinear response of the reactor core blocks in the event of a seismic occurrence. The computer code is developed for a specific mathemtical model which represents a vertical arrangement of layers of blocks. This comprises a block module of core elements which would be obtained by cutting a cylindrical portion consisting of seven fuel blocks per layer. It is anticipated that a number of such modules properly arranged could represent the entire core. Hence, the predicted response of this module would exhibit the response characteristics of the core.

48690 (CAAP-TR—052) **Pretest mediction of Semiscale Test S-07-10 B.** Dobbe, C.A. (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1979. Contract EY-76-C-07-1570. 41p. Dep. NTIS, PC A03/MF A01.

A best estimate prediction of Semiscale Test S-07-10B was performed at INEL by EG and G Idaho as part of the RELAP4/MOD6 code assessment effort and as the Nuclear Regulatory Commission pretest calculation for the Small Break Experiment. The RELAP4/MOD6 Update 4 and the RELAP4/MOD7 computer codes were used to analyze Semiscale Test S-07-10B, a 10% communicative cold leg break experiment. The Semiscale Mod-3 system utilized an electrially heated simulated core operating at a power level of 1.94 MW. The initial system pressure and temperature in the upper plenum was 2276 psia and 604°F, respectively.

48691 (CONF-790615—15) **LOFT experiment L2-2: analysis of the first ten seconds.** Linebarger, J. (Idaho National Engineering Lab., Idaho Falls (USA)). 1979. Contract EY-76-C-07-1570. 18p. Dep. NTIS, PC A02/MF A01.

From 3. US national congress on pressure vessels and piping; San Francisco, CA, USA (25 Jun 1979).

Data are presented on fuel cladding temperatures, momentum flux, coolant temperatures, and fluid densities.

48692 (CONF-790802—12) **UO_2 pore migration and grain growth kinetics.** Olsen, C.S. (Idaho National Engineering Lab., Idaho Falls (USA)). 1979. Contract EY-76-C-07-1570. 13p. Dep. NTIS, PC A02/MF A01.

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

A mathematical model for determining the UO_2 grain growth rate was developed in order to evaluate UO_2 steady-state creep rates and fracture strengths. This model may also be applied in the postirradiation examination of UO_2 nuclear fuel rods to estimate fuel temperatures experienced during experiments performed in the Loss-of-Fluid Test (LOFT) facility at the Idaho National Enginering Laboratory. The model was developed from a study of experimental data of UO_2 grain growth rates and of pore migration rates in UO_2 and effects of pore size and bubble pressure upon the migration rates. Because pores attached to UO_2 grain boundaries inhibit the rate of grain growth, a study of grain growth kinetics must consider the UO_2 pore migration rates.

48693 (EGG/SEMI/TR—006) **Experiment data for determination of uncertainty of two-phase mass flow rate in a Semiscale Mod-3 system spool piece at Karlsruhe Kernforschungzentrum.** Stephens, A.G. (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1979. Contract EY-76-C-07-1570. 117p. Dep. NTIS, PC A06/MF A01.

Steady state, steam-water testing of a Semiscale Mod-3 system instrumented spool piece was accomplished in the Gesellschaft fur Kernforschung (GfK) facility at Karlsruhe Kernforschungzentrum, West Germany. The testing was undertaken to determine the accuracy of spool piece, two-phase mass flow rate, inferential measurements by comparison with upstream single-phase reference measurements. Other two-phase measurements were also made to aid in understanding the flow conditions and to implement data reduction. A total of 132 single- and two-phase test points were acquired, covering pressures from 0.4 to 7.5 MPa, flow rates from 0.5 to 4.9 kg/s, and two-phase mixture qualities from 1.0 to 83% in the 66.7 mm inside diameter spool piece. The report includes a detailed description of the hardware and software and a tabulation of the data.

48694 (EPRI-NP—677) **Analytical models and experimental studies of centrifugal-pump performance in two-phase flow.** Wilson, D.G.; Chan, T.; Manzano-Ruiz, J. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Mechanical Engineering). May 1979. 220p. Dep. NTIS, PC A10/MF A01.

The existing two-phase flow data for centrifugal pumps are reviewed. A short survey of previous work on the modelling of two-phase pump flow is made. There are few models which attempt to cover the two-phase range from fully liquid to fully gaseous flow, and none has been found to predict the flow even in the first quadrant of operation with acceptable accuracy. A new method of modelling the two-phase performance of pumps is developed and applied to existing data.

48695 (EPRI-NP—1001) **EPRI—CURL dynamic analysis of loop type LMFBRs. Final report.** Cady, K.B.; Pavlenco, G.F.; Raber, J.R.; Khatib-Rahbar, M. (Cornell Univ., Ithaca, NY (USA)). May 1979. 516p. Dep. NTIS, PC A22/MF A01.

A computer-aided simulation is developed to analyze the transient behavior of loop type liquid metal-cooled fast breeder reactor plants. A set of nuclear, heat transfer, sodium dynamics, steam/water thermodynamics and control models for the multi-loop plant is developed to simulate operational, incident and accident transients. The major important features of the model include: (1) a multi-loop simulation, consisting of a single loop and the remaining lumped loops; (2) a method to calculate the characteristic times for every differential equation, and apply the Runge—Kutta algorithm to variables with slow and moderate time responses as compared to the integration time step and evaulate the variables with fast responses from a prompt approximation to assure numerical stability and reduce the computation time; and (3) a pre-accident initialization method by forcing most variables into their prompt approximation. The analytical submodels of the EPRI—CURL Code simulates: (a) the dynamics of sodium flows in the primary and secondary systems governed by forced and natural circulation; (b) reactor heat transfer; (c) neutron kinetics, reactivity feedbacks, and reactor power control; (d) intermediate heat exchanger heat transfer; (e) sodium transport delays in the primary and secondary systems; (f) steam/water thermodynamics, normal feed water flow and auxiliary feed water flow control; and (g) turbine header, throttle, steam bypass and relief flow control. There is a total of 489 first order ordinary differential equations modelling the entire plant. The EPRI—CURL systems analysis computer code for loop-type liquid metal cooled fast breeder reactors is used to model the plant response of a typical LMFBR to several transient conditions.

48696 (ESG-DOE—13264) **Reactor safety. Quarterly technical progress report, October—December 1978.** (Atomics International Div., Canoga Park, CA (USA)). 8 Jun 1979. Contract EY-76-C-03-0824. 44p. Dep. NTIS, PC A03/MF A01.

Progress is summerized in LMFBR safety studies related to the characterization of sodium fires and fission products. Included are sections on SOMIX Code development, sodium splash dispersal, aerosol leakage, aerosol model improvement, characterization of aerosol source term, large scale molten fuel tests, fuel and fission product release from burning sodium, and iodine attenuation.

48697 (GRS-F—55) **Reports on the research projects in the field of reactor safety sponsored by the Federal Ministry for Science and Technology. Period under report: October 1—December 31, 1977.** (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Apr 1978. 635p. (In German). Dep. NTIS (US Sales Only), PC A99/MF A01.

Investigations on the safety of Light Water Reactors (LWR) being performed in the framework of the safety program 'Reactor Safety' are sponsored by the Bundesminister fuer Forschung und Technologie (BMFT - Secretary of State for Research and Technology). Objective of this program is to continue improving the safety of LWRs, in order to minimize the risk for the environment. With grant assistance from the Bundesminister des Innern (BMI - Secretary of State for Home Affairs) research contracts in the field of reactor safety are being performed. Results of these projects should contribute to resolving questions arising from nuclear licensing procedures. The Forschungsbetreuung (FB - research supervision department) at the Institute for Reactor Safety (IRS), as consultants to BMFT and BMI, provides information about the progress of investigations. Individual reports will be prepared and put into standard forms by the research contractors. Each report gives information on: 1) the work accomplished, 2) the results obtained, 3) the work planned to be continued. Initial reports of research projects describe in addition the purpose of the work. A BMFT-research program on the safety of Fast Breeders (Schneller Brutreaktor - SBR) is presently under discussion. In order to define several problems, investigations included in the present compilation (RS 139, 140, 143, 162) will be previously performed.

48698 (LA-UR—79-1145) **Fuel deformation in a loss-of-flow accident in the gas-cooled fast breeder reactor.** Wehner, T.R.; Eggen, D.T. (Los Alamos Scientific Lab., NM (USA); CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. de Surete Nucleaire). 1979. Contract W-7405-ENG-36. 10p. (CONF-790802—4). Dep. NTIS, PC A02/MF A01.

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The development and results are presented of the Northwestern University Fuel Rod Computer Code (NUFROD), a computer code for studying initial gross fuel deformation in an hypothetical loss-of-flow accident (LOF) in the gas-cooled fast breeder reactor (GCFR). The purpose of the study is to determine the mode of initial gross fuel deformation by examining the mechanical fuel behavior early in the transient. The manner in which the fuel breaks up can significantly alter later events in the accident sequence. The mechanical model of NUFROD includes effects of temperature, pressure, fuel creep, and spatial variation of material properties. Fuel/cladding mechanical interaction is excluded because the cladding expands away from the fuel during a LOF.

48699 (LA-UR—79-1230) **Heat transfer and thermal losses in above-core regions.** Bell, C.R.; Boudreau, J.E. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 19p. (CONF-790810—1). Dep. NTIS, PC A02/MF A01.

From 2. international seminar on containment of fast breeder reactors; Berlin, F.R. Germany (9 Aug 1979).

Heat transfer and thermal losses in above-core regions can substantially influence the conversion of thermal energy to damage potential following postulated core-disruptive accidents in a liquid metal fast breeder reactor. Any assessment of these influences is complex and difficult to substantiate because of the transient, interactive environment in which they occur. A perspective is developed for the role of heat-transfer processes in the context of fluid/structure dynamics, containment strength, accident severity, sodium involvement, and uncertainties in current knowledge. The Clinch River Breeder Reactor (CRBR) is used as an example to quantify this perspective. Containment limits are estimated for CRBR to allow a comparative evaluation of the containment tolerance as different physical effects are considered.

48700 (LA-UR—79-1918) **SIMMER-II code and its applications.** Smith, L.L. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 11p. (CONF-790816—13). Dep. NTIS, PC A02/MF A01.

From International meeting on fast reactor safety technology; Seattle, WA, USA (19 Aug 1979).

The significant features of SIMMER-II, a disrupted-core analysis code, are described. The code has the capabalities to begin space-time neutronics calculations from nonstationary reactor states, to track the intermixing of fuel of different enrichments, and to model the complicated heat- and mass-transfer processes that occur in the transition phase. Example calculations are presented for analyses of whole-core accidents and for analyses of experiments supporting the code models.

48701 (LTR—20-100) **RELAP4/MOD6 predictions comparisons with LOFT LOCE L2-2 data.** Kee, E.J.; White, J.R. (Idaho National Engineering Lab., Idaho Falls (USA)). 3 May 1979. Contract EY-76-C-07-1570. 93p. Dep. NTIS, PC A05/MF A01.

Comparisons are made between RELAP4/MOD6 predicted and experimental measured quantities for Loss-of-Fluid Test Loss-of-Coolant Experiment L2-2. These data comparisons provide a detailed record for subsequent analysis. Comparisons indicate that the trends in the system hydraulic response were generally predicted well. However, the broken cold leg break flow was probably overpredicted in subcooled and saturated critical flow which led to an incorrect core flow which resulted in overpredicting the fuel rod cladding surface temperature response.

48702 (LTR—20-103) **Preliminary posttest analysis of LOFT loss-of-coolant experiment L2-2.** White, J.R.; Grush, W.H.; Keeler, C.D. (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1979. Contract EY-76-C-07-1570. 100p. Dep. NTIS, PC A05/MF A01.

A preliminary posttest analysis of Loss-of-Coolant Experiment (LOCE) L2-2, which was conducted in the Loss-of-Fluid Test

(LOFT) facility, was performed to gain an understanding of the cause of the disparity between predicted and measured fuel rod cladding temperature responses in the LOFT core. LOCE L2-2 is the first experiment in the LOFT Power Ascension Series L2 (first series of LOFT nuclear experiments), which was designed to investigate the response of the LOFT nuclear core to the blowdown, refill, and reflood transients during LOCEs conducted at gradually increasing power levels. LOCE L2-2 was conducted at 50% power (25 MW, 26.38 kW/m). Results show that a core-wide rewet occurred early in the transient (during blowdown starting at about 7 s after rupture) which was not calculated in the pretest prediction analysis. This early core-wide rewet resulted in the peak fuel rod cladding temperatures being lower (by a mean value of 166°K for 24 thermocouples) than had been calculated. This preliminary posttest analysis was concerned solely with determining why the early core-wide rewet was not predicted by the RELAP4/MOD6 pretest analysis and be no means is it a complete posttest analysis of LOCE L2-2 results. However, during this analysis, several errors made in the prettest analysis were found, and their impact on the predicted results is assessed. Three factors were postulated to have caused the disparity between predicted and measured fuel rod cladding temperatures for LOCE L2-2: (a) the initial fuel rod stored energy, (b) the heat transfer surface, and (c) the hydraulics calculation. These factors were examined and are discussed in this report. It was determined that core hydraulics, as influenced by the calculation of broken loop cold leg break flow, was the major factor causing the disparity.

48703 (NUREG—0482) **Occupational radiation exposure at light water cooled power reactors. Annual report, 1977.** Peck, L.J. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Management and Program Analysis). Apr 1979. 91p. NTIS, PC A05/MF A01.

This report presents an updated compilation of occupational radiation exposures at commercial light water cooled nuclear power reactors (LWRs) for the years 1969 through 1977. The information contained in this document was derived from reports submitted to the United States Nuclear Regulatory Commission in accordance with requirements of individual plant Technical Specifications, and in accordance with Part 20.407 of Title 10, Chapter 1, Code of Federal Regulations (10 CFR Part 20.407). An additional 4 LWRs completed a full calendar year of commercial operation for the first time in 1977. This report now encompasses data from 57 commercially operating U.S. nuclear power plants. The number of personnel monitored at LWRs increased approximately 10% in 1977, and the average collective dose to personnel (man-rems per reactor-year) increased 14% over the 1976 average. The average number of personnel receiving measurable exposure per reactor increased 11%, and the average exposure per individual in 1977 was 0.8 rem per person.

48704 (NUREG—0558) **Population dose and health impact of the accident at the Three Mile Island Nuclear Station. Preliminary estimates for the period March 28, 1979—April 7, 1979.** Battist, L.; Congel, F.; Buchanan, J.; Peterson, H. (Nuclear Regulatory Commission, Washington, DC (USA)). May 1979. 104p. Dep. NTIS, PC A06MF A01.

This report contains a preliminary assessment of the radiation dose and potential health impact of the accident on March 28, 1979 at the Three Mile Island Nuclear Station. This assessment was prepared by a task group composed of technical staff members from The Environmental Protection Agency, The Department of Health, Education and Welfare, and The Nuclear Regulatory Commission. The estimated dose that might have been received by an individual is less than 100 mrem. The collective dose received by the 2,164,000 people estimated to live within 50 miles of the reactor site is calculated to be 3,300 person-rem (with a range of 1600 to 5300 person-rem). This corresponds to an average dose of approximately 1.5 mrem. The potential number of fatal cancers that is projected to occur as a result of the accident is less than 1. This potential impact would be undetectable compared to the 325,000 cancer deaths that would normally be expected to occur in a population of 2,164,000. The estimated total health impact, including fatal and non-fatal cancers and genetic effects to all future generations is approximately 2 health effects.

48705 (NUREG/CR—0517) **Oxidation and embrittlement of zircaloy-4 cladding from high temperature film boiling operation.** Seiffert, S.L.; Hobbins, R.R. (Idaho National Engineering Lab., Idaho Falls (USA)). Apr 1979. Contract EY-76-C-14-2170. 85p. (TREE—1327). NTIS PC E03/MFE03.

Cladding embrittlement resulting from the high temperature oxidizing reactions with the coolant and the fuel is evaluated and compared with failure criteria. The data evaluated are from the Power-Cooling-Mismatch and Irradiation Effects Test Series performed in the Power Burst Facility reactor. The in-pile data are correlated with room temperature embrittlement criteria based on the fraction of remaining beta phase, the total extent of oxidation, and the mean oxygen concentration near saturation in the beta phase. The applicability of other failure criteria is discussed. The results of this study show that the in-pile data are most consistent with criteria based on the mean oxygen content in the beta phase, which suggests that time and temperature critically affect the ultimate cladding oxygen distribution and the extent of cladding embrittlement.

48706 (NUREG/CR—0556) **Aerodynamic considerations on the injection of tornado-generated missiles from ground level into tornado flow fields.** Hall, R.T. (Naval Surface Weapons Center, Silver Spring, MD (USA)). May 1979. 94p. NTIS, PC A05/MF A01.

This investigation examines, from the aerodynamic viewpoint, the necessary conditions required to lift relatively large, heavy objects from ground level, into a tornado flow field. The specific objects of interest are a Schedule 40,12" diameter steel pipe and a 4,000 pound family sedan-type automobile. Analyses consider, in addition to the aerodynamic characteristics of the objects of concern, the surface boundary layer at or very near the tornado funnel, aerodynamic ground effects and possible injection modes.

48707 (NUREG/CR—0647) **Fuel rod behavior during test PCM-2.** Mehner, A.S.; Vinjamuri, K. (Idaho National Engineering Lab., Idaho Falls (USA)). Apr 1979. Contract EY-76-C-07-1570. 80p. (TREE—1332). PC E03/MF E03.

The results are presented from the Power-Cooling-Mismatch (PCM) Test Series, Test PCM-2, conducted in the Power Burst Facility at the Idaho National Engineering Laboratory. Four unirradiated pressurized water reactor (PWR) type fuel rods were subjected to eight departure from nucleate boiling (DNB) cycles to provide data on the thermal hydraulic conditions which affect the onset of DNB and termination of film boiling operation during nuclear operation in a PWR environment. During the last DNB cycle, film boiling conditions were continued for up to 117 seconds to provide data on the effects of sustained film boiling operation on fuel rod thermal and mechanical behavior. Conclusions were reached on factors which affect the onset of DNB and termination of film boiling, the effects of sustained film boiling on fuel rod behavior, and the resultant damage to the rod when cladding temperatures equilibrate in the high alpha phase (810 to 1105 K) temperature range and above the beta phase transformation temperature (> 1245 K).

48708 (NUREG/CR—0815) **Experiment data report for Semiscale Mod-3 lower plenum injection test S-07-9 (baseline test series).** Miyasaki, D.H.; Sackett, K.E.; Pack, D.R. (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1979. Contract EY-76-C-07-1570. 255p. (TREE—1229). Dep. NTIS, PC A12/MF A01.

Recorded test data are presented for Test S-07-9 of the Semiscale Mod-3 baseline test series. This test is one of several Semiscale Mod-3 experiments conducted to investigate the thermal and hydraulic phenomena accompanying a hypothesized loss-of-coolant accident in a pressurized water reactor (PWR) system. Test S-07-9 was conducted from initial conditions of 16.10 MPa and 559 K to investigate the response of the Semiscale Mod-3 system to a blowdown transient following a simulated double-ended offset shear of the broken loop cold leg piping. The specific objective of this test was to provide reference data to evaluate integral blowdown and reflood behavior during a 200% cold leg break with emergency core coolant (ECC) injection into the vessel lower plenum of the Mod-3 system. The purpose of this report is to make available the uninterpreted data from Test S-07-9 for future data analysis. The data, presented in the form of graphics in engineering units, have been analyzed only to the extent necessary to ensure that they are reasonable and consistent.

48709 (NUREG/CR—0822) **Effect of scale on two-phase countercurrent flow flooding in annuli. Final report, April 1978—March 1979.** Richter, H.J.; Murphy, S.L. (Dartmouth Coll., Hanover, NH (USA). Thayer School of Engineering). 1979. 39p. NRC.

Air-water flooding experiments were performed in an annulus approximately 2/15th the size of a nuclear reactor. The necessary gas velocity to prevent any downward water penetration was found to be a function of the way the water was introduced into the annulus. If water were allowed to enter only on one side instead of around the total circumference, the gas velocity for zero penetration had to be increased. The flooding characteristic can be described with a Wallis correlation where the coefficients are functions of the method of water injection into the annulus.

48710 (NUREG/CR—0839) **Study of thermal and hydrodynamic processes associated with melting of horizontal substrate.** Taghavi-Tafreshi, K.; Dhir, V.K. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). May 1979. 83p. NTIS, PC A05/MF A01.

The melting of a horizontal slab of frozen olive oil placed beneath a pool of warm water has been studied experimentally. The interfacial heat flux data are taken in quasi-static mode by noting the time rate change of enthalpy of the pool of water. Because of little agitation of the pool due to low melt volume flux (rho/sub w//rho/sub o/ $\sim$ 1.09; ΔT = 5 to 45K), the pool was found to stratify with time. Hence, heat transfer coefficient data have been based on both

the mean pool temperature and the interfacial temperature. Visual observations show that melt removal is governed by Taylor instability and that melt releasing nodes lie about a Taylor wavelength apart. Predictions of the interface growth based on equilibrium between surface tension and buoyant forces have been made and found to compare well with the data obtained from the movies. The heat transfer coefficient data obtained at higher pool temperatures are also predicted well by the theoretical model.

48711 (NUREG/CR—0840) **FRAP-T5: a computer code for the transient analysis of oxide fuel rods.** Siefken, L.J.; Bohn, M.P.; Peck, S.O.; Dearien, J.A. (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1979. Contract EY-76-C-07-1570. 356p. (TREE—1281). Dep. NTIS, PC A16/MF A01.

The Fuel Rod Analysis Program - Transient (FRAP-T5) is a FORTRAN IV computer code that calculates the transient response of light water reactor fuel rods during hypothesized accidents such as a loss-of-coolant accident or a power-cooling mismatch. The code calculates the temperature, pressure, deformation, and failure histories of a fuel rod as functions of time-dependent fuel rod power and coolant boundary conditions. The phenomena modeled by the code include: (a) heat conduction, (b) elastic—plastic fuel and cladding deformation, (c) fuel-cladding mechanical interaction, (d) fission gas release, (e) transient fuel rod gas pressure, (f) heat transfer between fuel and cladding, (g) cladding oxidation, (h) cladding annealing, and (i) heat transfer from cladding to coolant. The code contains all the needed material properties, water properties, and heat transfer correlations. The code includes a user's option that automatically provides a detailed uncertainty analysis of code calculated response parameters. FRAP-T5 is programmed on the CDC 7600 computer and is structured to enable direct linkage to a thermal-hydraulic code for transient analysis.

48712 (NUREG/CR—0845) **Steam—water mixing and system hydrodynamics program. Task 4. Quarterly progress report, October 1978—December 1978.** Collier, R.P.; Dworak, J.A.; Flanigan, L.J.; Liu, J.S.; Segev, A. (Battelle Columbus Labs., OH (USA)). May 1979. 49p. (BMI—2028). NTIS.

During this quarter analysis included further development of the I* scaling parameter for tubes, a continuing review of the effects of distortion of annulus length on scaling, and further development of the condensation/vaporization model. This model descrbes the one-dimensional flow of a liquid film draining down a heated wall in the presence of countercurrent vapor flow. Theoretical predictions were compared with data obtained in 1/15- and 2/15-scale models, with reasonably good agreement. Experimental work carried out this quarter included completion of distorted annulus length tests in the 2/15-scale model and design and construction of two small test facilities for analysis support. One facility is a vertical tube test section for countercurrent flooding experiments. The second facility is a rectangular channel with a heated wall for condensation and vaporization experiments.

48713 (NUREG/CR—0850) **ECC Bypass scaling.** Richter, H.J.; Wallis, G.B. (Dartmouth Coll., Hanover, NH (USA). Thayer School of Engineering). May 1979. 40p. NTIS, PC A02/MF A01.

The "state of the art" on ECC Bypass for Nuclear Reactors is evaluated. Comparison of experimental results of different authors show that condensation, vent valves, and the mode of water injection are important in the consideration of ECC Bypass

48714 (NUREG/CR—0872) **Crab user's manual.** Jordan, H.; Gieseke, J.A.; Schumacher, P.M. (Battelle Columbus Labs., OH (USA)). May 1979. 30p. (BMI—2027). NTIS, PC A03/MF A01.

The CRAB reference code for contained aerosol behavior is described. The model equation used is presented and the numerical solution technique -- finite element discretization coupled with the GEAR ordinary differential equation solver -- is discussed briefly. A detailed account of this technique is contained in an earlier report. Input required by CRAB is given in detail, as is the result of a sample run. CRAB is intended to provide a best estimate of aerosol behavior in a homogeneously mixed containment as a reference for less rigorous but more practical codes.

48715 (SAN—0115-T5) **Experimental studies in CDA work-energy attenuation. Quarterly progress report No. 17, 1 January to 31 March 1979.** Tobin, R.J.; Cagliostro, D.J.; Romander, C.M.; Goodale, T.C. (SRI International, Menlo Park, CA (USA)). 31 Mar 1979. Contract EY-76-C-03-0115. 22p. Dep. NTIS, PC A02/MF A01.

The objectives of this program are to: develop a basic understanding of the dynamics and thermodynamics of expanding bubbles similar to the core disassembly accident (CDA) bubble in liquid metal fast breeder reactors (LMFBR); determine experimentally the structural response of an LMFBR to simulated CDA loads resulting from a postulated fuel vapor expansion; investigate potential hazards of CDA-generated missiles and sodium fires to the secondary containment system of the reactor; and investigate phenomena that may limit the work potential of HCDA bubble expansions.

48716 (TFBP-TR—323) **Reactivity Initiated Accident Test Series Test RIA 1-4: experiment operating specification.** Stanley, C.J.; Martinson, Z.R. (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1979. Contract EY-76-C-07-1570. 69p. Dep. NTIS, PC A04/MF A01.

This document describes the experiment operating specifications for the Reactivity Initiated Accident (RIA) Test RIA 1-4 to be conducted in the Power Burst Facility (PBF) at the Idaho National Engineering Laboratory as part of the Nuclear Regulatory Commission's Fuel Behavior Program. RIA Test Series I objectives are to provide data for the evaluation and possible revision of current nuclear reactor licensing criteria regarding hypothetical control rod drop or ejection accidents in commercial nuclear power plants. These experiments will also provide fuel performance data during a RIA event for model development and assessment purposes. Test RIA 1-4 will consist of a 3 x 3 array of preirridiated fuel rods. The nine fuel rods will be 5.7 wt% enriched UO_2, zircaloy-4 clad, Westinghouse MAPI rods irradiated to an average burnup of approximately 5250 MWd/t in the SAXTON pressurized water reactor.

48717 (UCRL—81359) **Applicability of flat plate methods in determining fluid/structure interaction effects in BWR pressure suppression systems.** Holman, G.S.; McCauley, E.W.; Lu, S.C.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Mar 1979. Contract W-7405-ENG-48. 21p. (CONF-790802—23). Dep. NTIS, PC A02/MF A01.

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Flat plate chord tests are one experimental method used to investigate how fluid/structure interaction (FSI) effects modify the impulsive loading in nuclear reactor pressure suppression pools. This analytical study examines the applicability of using a flexible flat plate in an otherwise rigid shell to model dynamic pool wall response in a flexible shell pressure suppression torus. Bubble pressures varying by a factor of seven are used as input to two-dimensional finite-element models. Boundary response to various plate and shell thicknesses are compared on the basis of equivalent natural frequency. Results indicate the qualitative flat plate response compares well with the flexible shell but absolute pressures vary significantly and nonconservatively.

48718 (UCRL—82435) **Analytical and experimental Mark I boiling water reactor containment safety research at the Lawrence Livermore Laboratory.** McCauley, E.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Mar 1979. Contract W-7405-ENG-48. 17p. (CONF-790802—19). Dep. NTIS, PC A02/MF A01.

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

An overview of research work is discussed which addresses both large scale experimental and multidimensional analytical containment studies conducted at the Lawrence Livermore Laboratory since 1976. The Mark I Boiling Reactor (BWR) containment design is the subject of interest. In the experimental program, particular focus is placed on quantification of loss-of-coolant-accident (LOCA) induced loads. The focus of the analytical effort is toward understanding of fluid/structure interaction effects due both to LOCA induced loads and safety relief value (SRV) loads in the Mark I BWR pressure suppression wetwell (a segmented torus).

48719 (ZJE—214) **Two-criteria approach to reactor pressure vessel safety and reliability evaluation.** Brumovsky, M. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1977. 22p. Dep. NTIS (US Sales Only), PC A03/MF A01.

The crack-initiation approach and the crack-arrest approach are the two techniques most often used nowadays for evaluating the safety of pressure vessels. The former is based on the methods of Linear Elastic Fracture Mechanics and Fracture Toughness, while the Fracture Analysis Diagram and the Crack Arrest Temperature underlie the latter. By introducing some formalism and the unified temperature (Tsub(R)), a formal unification of both approaches mentioned above is sought for. Experimental data suggest using the Nil Ductility Temperature as a reference temperature for both approaches. Using the theoretical background of linear elastic fracture mechanics it is possible to construct the Defect Analysis Diagram which summarizes the dependencies of critical sizes of flaws. The dependence on the crack arrest temperature is also included, which seems to be highly advantageous. In this way it is possible with the use of only one diagram to determine all necessary parameters either for critical or allowable state of the pressure vessel (or of other type of equipment) in the stage of design, manufacture and exploitation. This process is easy as the inlet of the changes in mechanical properties or flaw size induced in material by exploitation means only some shift of scales. This diagram is applicable also for the evaluation of results received from the in-service inspections of pressure vessels.

48720 Port interface requirements. O'Neil, R. (UKAEA). pp 71-87 of Symposium sur la surete des navires nucleaires. Paris, France; OECD (1978).

From Symposium on the safety of nuclear ships; Hamburg, F.R. Germany (5 Dec 1977).

In a land-based reactor programme the Administration are usually confronted with a specific design in a particular environment. Safety and Reliability criteria necessary to the designer can be specified on the basis of acceptable risk to the population. However for the successful implementation of a nuclear ship programme on a broad commercial basis it is necessary to have agreed standards of risks from ships yet to be designed and agreed standards of acceptable risks to the population at likely ports of call yet to be specified, consulted, or agreed. At first sight it would seem that this double uncertainty must either lead to unnecessarily high safety standards for the ship or unacceptably conservative standards for berth selection. The paper discusses the problem and proposes a possible solution based on the concept of a 'Standard Port' and a 'Standard Ship' and indicates the level of risk implied by such a concept.

48721 Symposium sur la surete des navires nucleaires. (Symposium on the safety of nuclear ships). Paris, France; OECD (1978). vp. (CONF-771212—).

From Symposium on the safety of nuclear ships; Hamburg, F.R. Germany (5 Dec 1977).

Two methods of radiocarbon assay in natural water are described: gas counting of synthesized methane in a proportional counter and liquid scintillation counting of synthesized benzene. A method of field sampling is described in which carbonates are precipitated in a special sampler. Highly mineralized waters must be treated with acid for carbon dioxide evolution. A comparison of the two counting methods showed the superiority of benzene synthesis and liquid scintillation counting where accuracy better than +-1% of modern radiocarbon is easy to obtain.

48722 Underground siting of nuclear power reactors, determination of site characteristics, and general site availability in California. Sacramento, CA; California Energy Resources Conservation and Development Commission (1978). 62p. (NP—23810).

This report details the criteria and conclusions developed by staff of the Energy Commission pertaining to general site availability for underground nuclear power plants. Establishing the existence of technically suitable siting areas was deemed an integral part of the overall study of underground nuclear power reactors. Specifically, this portion of the study deals with parameters, both physical and social, which could influence or limit the siting of underground nuclear power plants in California. Siting criteria were developed for two sub-surface concepts: (1) berm-contained plants, wherein the reactor and principal radioactivity-containing structures are covered with soil; and, (2) rock sited plants, wherein the reactor and principal systems are located in large caverns excavated in competent rock.

48723 Conceptual design and estimated cost of buried "berm contained" nuclear power plants. Executive summary. Sacramento, CA; California Energy Resources Conservation and Development Commission (1978). 15p. (NP—23809).

A conceptual study has been made of the the technical feasibility and cost of berm-contained nuclear power plants (a berm-contained plant has all, or part, of its structure covered with soil). A principal objective of this study was to achieve a design that would reduce the potential release of radioactivity that could result if accidents of the very severe nature, involving a melting of the reactor core, were to occur. These are termed Class 9 accidents by the Nuclear Regulatory Commission and are not now a design-basis requirement for nuclear power plants because of their probability of occurrence has been estimatd to be very low. A number of core-melt accident scenarios were considered by ERCDC in developing the facility design requirements for this study. These postulated accidents were selected with the goal of enveloping the range of expected core-melt characteristics in order to ensure the adequacy of the design of the systems required to mitigate their consequences. One of the most severe scenarios for the Class 9 accidents included permanent and total loss of all ac power, both onsite and offsite. The probability of such a power loss extending for the long periods of time associated with such a severe accident is very low. The utilization of such a scenario in this study is typical of the application of the conconcept of specifying an envelope of limiting accident conditions for design of accident mitigation systems for the berm-contained facilities. The design requirements for these very severe, very low probability, core-melt accidents were specified in terms of containment pressure, energy, and temperature time-histories which comprised the basis for the development of structural design and accident-management systems design. From these results, first-order cost estimates were prepared for baseline designs and for a number of parametric site characteristic variations.

ENERGY STORAGE

REFER ALSO TO CITATION(S) 48751, 48875

MAGNETIC

REFER ALSO TO CITATION(S) 48725

COMPRESSED GAS

48724 (SAN—1331-T1) Feasibility of compressed air energy storage as a peak shaving technique in California. Consultant report. Volume II. (Acres American, Inc., Buffalo, NY). Sep 1978. Contract EY-76-C-03-1331. 540p. Dep. NTIS, PC A23/MF A01.

The purpose of the study was to identify the technical, economic, and siting feasibility, on a preliminary basis, of the use of compressed air energy storage in the State of California. The report is essentially organized according to these three major divisions of scope. The first seven sections are devoted to reporting the results of the siting feasibility study activities. The siting methodology, site search, and ranking of sites are discussed in Sections 1 through 5. Section 6 presents site documentation, and Section 7 summarizes the siting feasibility results. Additional site documentation and details of the ranking criteria are contained in Appendices A, B, and F. The economic feasibility of CAES in California is presented in Section 8. The analysis was performed on a parametric basis using gas turbines and combined cycle plants as a comparison. The methodology, base data, and results are presented in this section, and the computer program used is presented in Appendix E. The design sites for porous media and compensated hard rock are documented in Section 9, along with an alternate site for each type of plant. The results of the technical feasibility portion of the study, the plant designs for porous media and hard rock storage, are presented in Sections 10 and 11. Appendices C and D contain discussions of projected developments in gas turbine generators and CAES plant designs, as both technologies are expected to advance in the near term. Cost estimates and construction schedules have been prepared for the plant designs of Sections 10 and 11, and are presented in Section 12 and Appendix H. Section 13 summarizes the results and conclusions of the study, and the Recommendations are contained in Section 14.

FLYWHEELS

REFER ALSO TO CITATION(S) 48725

THERMAL

REFER ALSO TO CITATION(S) 48783, 48828

48725 Materials innovations in the development of energy storage systems. Swisher, J.H. (Dept. of Energy, Washington, DC); Myles, K.M. *J. Mater. Energy Syst.;* **1**: No. 1, 5-19(Jun 1979).

The principal function of energy storage technology in the energy program is to permit more efficient and more economic use of intermittent energy sources, e.g., solar, wind, and off-peak electrical power, for applications in which there is a mismatch in timing of energy supply and demand. Another important function of energy storage technology is to permit more extensive use of waste heat through efficient heat storage and transport. As in many other parts of the energy program, the development of new and improved materials is a vital if not critical part of the energy storage R and D effort. Examples of key projects in which significant progress has been made recently are media for thermal energy storage, hydrides and containment materials for chemical energy storage, composite materials for flywheels, high current conductors for superconducting magnetic energy storage, and a multitude of new materials for batteries and other electrochemical devices. Special emphasis is now being given to storage components for electric and hybrid vehicles. Batteries with flywheels for regenerative braking offer attractive options for power systems and emerging opportunities for materials R and D specialists.

CHEMICAL

REFER ALSO TO CITATION(S) 48725

BATTERIES

DESIGN AND DEVELOPMENT

48726 (AD-A—061426) **Silver-hydrogen energy storage. Final report, 15 June 1976—15 June 1978.** Holleck, G.L.; Turchan, M.J.; Shuker, F.S.; DeBiccari, D.; Turner, M.J. (EIC, Inc., Newton, MA (USA)). Aug 1978. Contract F33615-76-C-2093. 236p. NTIS PC A11/MF A01.

During this program we have demonstrated the feasibility of Ag/H_2 cells with 35 to 50 Wh/lb, depending on the desired discharge rate, and with a cycle life in excess of 500 deep discharges. This demonstration and the necessary development involved extensive component level studies and performance evaluation using several sets of laboratory cells of approximately 15 Ah, in addition to the development of a comprehensive computerized mathematical model for the design and optimization of Ag/H_2 cells of rolled stack configuration. Electrolyte management was identified as the main problem area. The relatively high solubility of silver oxide in the electrolyte necessitates the use of argentistatic membranes similar to those employed in Ag/Zn cells. These membranes have characteristic electrolyte transport properties described by their transference, diffusion and flow parameters. The authors determined those parameters and showed that a suitable combination of the individual transport characteristics is required to maintain an adequate electrolyte balance during any one charge-discharge cycle and from cycle to cycle.

48727 **Sodium-sulfur battery: a storage equipment for peak load compensation and electric traction motors.** Fischer, W. (Brown, Boveri und Cie A.G., Heidelberg (Germany, F.R.). Zentrales Forschungslabor). *Metall;* **33**: No. 1, 38-41(Jan 1979). (In German).

Sodium/sulfur batteries, when fully developed, are expected to store about four times more energy per unit of mass, to be cheaper and to have a longer cycle life than lead acid batteries. They consist of cells in which molten sodium and sulfur are separated by a solid ceramic electrolyte. The cells are surrounded by a heat insulation in order to keep them on the operating temperature of 300-350°C. A few years more will be needed for the development of sodium/sulfur batteries. Because of their high energy density sodium/sulfur batteries will enable the construction of electric vehicles with a long range in comparison to vehicles propelled with lead acid batteries. Another application possibility is to use this type of battery for load levelling purposes in electric networks.

48728 **Gas-tight battery.** Seiger, H.N. (to Saft America, Inc., Valdosta, GA; Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 1,671,775/B/. 9 Feb 1978. 11p. (In German).

The invention refers to a gas-tight alkali secondary battery with a charging circuit, which can be used on satellites, which is switched on and off by a control current. The control current is supplied by an oxygen-consuming control electrode via a control device depending on the control current to the negative electrode. In order to be able to shorten the charging period appreciably, the control device actuates the switching device to switch off the charging process, according to the invention, at a value of control current which reaches the trip value, which corresponds to a slightly smaller value than that for the fully charged condition of the battery. Further impedance values of the control device and materials for the negative and control electrode are claimed.

48729 **Method to store and supply electrical energy by means of a galvanic cell.** Davis, S.M.; Schurdak, E.J.; Voorhies, J.D. (to American Cyanamid Co., Wayne, NJ; Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 1,671,671/C/. 17 Nov 1977. 4p. (In German).

Dry cells having a zinc anode, a separator and a cathodic depolarization mixture of azo-dicarbonamide and soot can be according to the invention made into a secondary cell by anodically oxidizing the depolarizer mixture consisting of soot of surface of at least $200m^2/g$, zinc and/or barium oxide, aqueous solution of zinc salt and hydrazondicarbonamide, shortly before the first use of the cell. The azo-dicarbonamide resulting from the anodic oxidation in reduced again to the hydrazo-discarbonamide during discharge of the secondary cell.

48730 **Electrochemical secondary cells and method for their manufacture.** Gay, E.C.; Martino, F.J. (to Energy Research and Development Administration, Washington, DC (USA); Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,613,164/A/. 14 Oct 1976. 26p. (In German).

Special electrode reactants such as sulphides of the transition metals for positive electrodes and lithium alloys for negative electrodes are fed into porous; electrically conducting substrate materials present in the form of solid foams or felts and are condensed by vibration. The remaising emply volume is filled with melted electrolyte salt such as LiCl-LiF-KCl in eutectic composition. Glass carbon, Graphite, iron, nickel, molybdenum, niobium and chromium are claimed as solid foams.

PERFORMANCE AND TESTING

48731 (AD-A—061609) **Power supplies for Arctic Radio Repeater systems.** Nagy, G.D. (Defence Research Establishment, Ottawa, Ontario (Canada)). Sep 1978. 50p. NTIS PC A03/MF A01.

This feasibility study assesses various long-lived, self-contained 30-watt power supplies for an Arctic Radio Repeater System. The study involves a review of the state of the art, availability and cost of five candidate systems: batteries, fuel cells, radioisotopic thermoelectric generators, fueled thermoelectric generators and windmill-battery systems. The above five candidates were also assessed as standby power units. Reliability, service and maintenance requirements are considered since the application calls for one year unattended operation and servicing by light helicopter on a single annual flight for all sites. Only zinc/air batteries with lead/acid batteries for the standby system are available now. Their cost is moderate, but zinc/air cells are heavy and must be replaced each year. Other systems could be available in the 1980's but they would require various amounts of development work and evaluation in an arctic environment. Recommendations and priorities for development of the systems which could replace the zinc/air cells at a later date are given. (Author)

48732 (DOE/NASA/1044—79/3) **Effect of positive pulse charge waveforms on cycle life of nickel—zinc cells.** Smithrick, J.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jul 1979. Contract EC-77-A-31-1044. 15p. (NASA-TM—79215). Dep. NTIS, PC A02/MF A01.

Five-amp-hour nickel—zinc cells were life cycled to evaluate four different charge methods. Three of the four waveforms investigated were 120-Hz full-wave-rectified sinusoidal (FWRS), 120-Hz silicon-controlled rectified (SCR), and 1-kHz square-wave (SW). The fourth, a constant-current method, was used as a baseline of comparison. Three sealed Ni—Zn cells connected in series were cycled. Each series string was charged at an average C/20 rate, and discharged at a C/2.5 rate to a 75% rated depth. Results indicate that the relatively inexpensive 120-Hz FWRS charger appears feasible for charging 5-Ah nickel—zinc cells with no significant loss in average cycle life when compared to constant current charging. The 1-kHz SW charger could also be used with no significant loss in average cycle life. This result suggests the possibility of utilizing the existing electric vehicle chopper controller circuitry for an on-board charger. There was an apparent difference with the 120-Hz SCR charger as compared to the others; however, this difference could be due to an inadvertent severe overcharge, which occurred prior to cell failure. The remaining two positive-pulse-charging wave-forms, FWRS and 1 kHz, did not improve the cycle life of 5-Ah nickel—zinc cells over that of constant-current charging. 10 figures, 2 tables.

MATERIALS, COMPONENTS, AND AUXILIARIES

REFER ALSO TO CITATION(S) 48726

48733 (AD-A—061487) **Measurement of the rates of diffusion of soluble zinc through membrane materials in KOH solution by differential pulse polarography and comparison with potentiometric methods.** Kilroy, W.P.; Laughlin, L. (Naval Surface Weapons Center, Silver Spring, MD (USA)). 30 Oct 1978. 23p. NTIS PC A02/MF A01.

The rate of zincate diffusion through battery membrane materials has been measured by potentiometry and compared to a new technique employing differential pulse polarography.

48734 **Silver-zinc battery.** Howard, P.L. (to Timex Corp., Waterbury, CT (USA); Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,559,296/A/. 28 Oct 1976. 12p. (In German).

Silver-zinc small batteries with silver monoxide and an additive as cathode materials supply an essentially constant battery voltage of 1.48 to 1.68 volt during the entire lifetime of the primary battery if one mixes as additive or resistance material reducing the battery voltage without efficiency the capacity with the silver monoxide. Sulphur or silver sulphide is taken as additive with a share of up to 20 wt.-%.

ENERGY MANAGEMENT AND POLICY

REFER ALSO TO CITATION(S) 48873

48735 **New York State energy conference proceedings.** New York, NY; New York State Energy Office (1978). 88p. (CONF-7809163—).

From New York state energy conference; New York, NY, USA (20 Sep 1978).

This volume, presenting the conference proceedings, contains an array of energy policy ideas, suggestions, and directions. Two fundamental themes evolved from the conference - that effective energy policies cannot be developed in isolation from other relevant policy considerations and that there was an awareness of the need for an integrated approach in planning for the state's energy future. Conference participants evaluated the relevant issues attending each major fuel option through a series of panel sessions. Conventional fuels provided the substantive focus of the Petroleum Products, Natural Gas, Coal, Electricity, and Nuclear Waste Management panels. Each conventional fuel panel addressed the proper role of each fuel type in the state's energy future within the context of national energy policy, fuel availability, New York State conditions, technological status, and relative fuel prices. The role of cost-effective energy conservation measures in the state's future was discussed by the members of the Conservation panel while a realistic appraisal of the energy contribution of certain non-conventional technologies during the next fifteen years formed the basis for the Resource Recovery, Small Hydroelectric, Wood, Solar, and Cogeneration panels.

ENERGY ANALYSIS AND MODELING

REFER ALSO TO CITATION(S) 48739, 48754, 48764, 48777, 48779, 48836, 48850

48736 (DOE/EIA—0182/4) **Midterm energy forecasting system: stand-alone boiler model results. Service report SR/OA/79-04.** Murphy, F.H.; Zalkind, J.H. (Department of Energy, Washington, DC (USA). Energy Information Administration). May 1979. 18p. Dep. NTIS, PC A02/MF A01.

The Council on Wage and Price Stability requested an analysis of the incremental impacts of Fuel Use Act regulations as a function of the stringency of the economic test under which exemptions are granted. To carry out this analysis, EIA utilized both the stand-along Industrial Boiler Fuel Choice Model and a version of the same model integrated with the mid-term energy forecasting system to generate projections of industrial boiler fuel demand under the specified assumptions. The purpose of this report is to transmit, without endorsement, preliminary numerical results of some model runs used to generate the requested projections. The Appendix to the Report provides the results based on regulatory scenarios and other assumptions supplied by COWPS. EIA considered several cases. They fall into two main categories: the first uses the Btu equivalent price of distillate to evaluate the fuel cost of using natural gas in boilers; the second uses the Btu equivalent residual oil price instead.

ECONOMICS AND SOCIOLOGY

REFER ALSO TO CITATION(S) 48736, 48747, 48765, 48767, 48773, 48774, 48785, 48843

48737 (AD-A—059282) **Initial testing of a disequilibrium adjustment mechanism for CPE macroeconometric models. Final report.** Bond, D.L. (Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring and Support Lab.). Jun 1978. Contract 77-B004691-000. 58p. NTIS PC A04/MF A01.

This report describes a disequilibrium adjustment mechanism for use in macroeconometric models of centrally planned economies. The mechanism is one that ensures that certain balances between supply and demand in specific sectors, or for specific factors, are adhered to in the model's solution. Given in initial set of endogenously determined variable values, the search for balance is designed to minimize the deviation from these initial values, while at the same time satisfying the balancing constraints. Results of an initial test of the mechanism are also presented.

48738 (ANL/EES-TM—25) **Regional energy environment data book draft: Midwest Region.** Barisas, S.G.; Ballou, S.W. (Argonne National Lab., IL (USA)). Oct 1978. Contract W-31-109-ENG-38. 869p. Dep. NTIS, PC A99/MF A01.

Assessments of regional impact arising from the promulgation of federal energy policies and the implementation of energy supply and conservation alternatives have led to the recognition that a need exists for increased information on the environmental, regulatory, and institutional status of the region. The compendium of data contained within the document will serve as a regional reference document for evaluating energy-related impacts on existing Midwest regional environmental conditions. The Midwest Regional Assessment (MRA) is being conducted as part of the Argonne National Laboratory Regional Studies Program. The MRA focuses on identifying and assessing regional response to the development of energy supply and conservation technologies and to changes in federal energy policies. The MRA is sponsored by the Department of Energy, Assistant Secretary for Environment, Division of Regional Assessments. The purpose of the Regional Studies Program is to assess the impacts and consequences associated with alternative energy options on a regional basis, and to identify and analyze alternative mitigation and solution strategies for increasing the acceptability of these options.

48739 (HCP/16346—01/2) **Survey of the research into energy-economy interactions. Volume 2. Annotated bibliography.** Coates, R.; Hanson, D.; Juenger, S.; Kennington, J. (Planco, Inc., Dallas, TX (USA)). Apr 1979. Contract EI-78-C-01-6346. 425p. Dep. NTIS, PC A18/MF A01.

This annotated bibliography contains abstracts of nearly 400 articles, books, and reports cited in Planco's Survey of the Research into Energy-Economy Interactions: Volume I. It represents the end result of an exhaustive search for recent (1960 to present) and ongoing research into energy-economy interactions. The search process uncovered more than 900 articles, books, and reports on energy and the economy. Of these, only the research directly related to macroeconomic energy-economy interactions was selected. In preparing the abstracts, every effort was made to use the authors' own summaries or excerpts from the publications. Not all of the publications cited in Volume I of the survey were abstracted.

48740 **Projections 1980—2000 of economic and demographic variables for CFM II: United States, California, economic regions, and major utility service areas. Summary tables of selected variables.** Levy, S.; Arnold, R.K. Palo Alto, CA; Center for the Continuing Study of the California Economy (1978). 492p. (NP—23854).

Projections of economic and demographic variables by year for the period 1980—2000 and historical estimates for selected years 1959—1976 are prepared for the US, California, and 7 economic regions and approximations to utility service areas of California. The economic and demographic variables for California and all economic regions and utility service areas included in this report are: total population; occupied households; personal income in $1975; taxable sales in $1975; total jobs; agricultural and nonagricultural wages and salaries; total jobs by 2 Digit Manufacturing and Nonmanufacturing industries; housing stock by type; new housing units by type. Specific variables for specific areas are identified. The economic and demographic variables for the US are: total population, GNP in $1975; personal income in $1975; personal consumption expenditure deflator; total jobs; total jobs by 2 Digit SIC Manufacturing and Nonmanufacturing Industries; wage and salary payments in $1975 by 2 Digit SIC Manufacturing and Nomanufacturing Industries; values added in $1975 by 2 Digit SIC Manufacturing Industries; yield on 3 to 5 year government bonds; yield on 3-month treasury bonds bills; Aaa bond rate. Methodologies are described in appendices. (MCW)

48741 **Energy accounting in human societies.** Slesser, M. (Univ. of Strathclyde, Scotland). pp 329-335 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

The following topics are discussed: importance of energy flux for analyzing human societies and their energy use; new industrial systems for utilizing high energy densities; energy as a limiting factor for some economics; development trajectories for various nations; gross domestic product per unit of energy for European countries; and gross energy requirements for manufactured goods. (HLW)

ENVIRONMENT, HEALTH, AND SAFETY

REFER ALSO TO CITATION(S) 48235, 48738, 48770

48742 (BNL—50814) **Effect of energy conservation on environmental emissions: utility, residential, and commercial sectors.** Raskin, P.D.; Rosen, R.A. (Energy Systems Research Group, Inc., Albany, NY (USA)). Sep 1977. Contract EY-76-C-02-0016. 41p. Dep. NTIS, PC A03/MF A01.

Environmental emissions in the utility, residential, and commercial sectors are estimated for four U.S. energy system scenarios and two future target years. Total utility emissions are estimated by specifying, for each scenario and year, total energy demands, fuel mixes, generating technologies, and air pollution control levels. In the residential and commercial sectors energy end-use requirements for space heating and cooling are determined and combined with end-use specific emission coefficients to calculate total emissions. The analyses show that emissions do not vary significantly among scenarios even though total energy use differs by as much as 45 quads. Low-energy demand scenario emissions increase relative to high-energy demand scenarios principally because of the relative

increase in coal usage. Utility sector emissions are greater than residential and commercial sector emissions.

NATURAL RESOURCES

REFER ALSO TO CITATION(S) 48108, 48749, 48754, 48770

48743 (IVA—137) **Natural gas in the Swedish energy policy.** Hjort, L. (Ingenjoersvetenskapsakademien, Stockholm (Sweden)). 1978. 141p. (In Swedish). Dep. NTIS (US Sales Only), PC A07/MF A01.

The use of natural gas in Sweden has been discussed for about ten years in Sweden. This report will give a summary of questions which are important in the energy policy when determining if natural gas ought to be introduced in Sweden as a fuel.

RESEARCH, DEVELOPMENT, DEMONSTRATION, AND COMMERCIALIZATION

48744 (DOE/ER—0029) **DOE research and development and field facilities.** (Department of Energy, Washington, DC (USA). Office of Field Operations Management). Jun 1979. 546p. Dep. NTIS, PC A23/MF A01.

This report describes the roles of DOE's headquarters, field offices, major multiprogram laboratories, Energy Technology and Mining Operations Centers, and other government-owned, contractor-operated facilities which are located in all regions of the United States. It gives brief descriptions of resources, activities, and capabilities of each field facility (sections III through V). These represent a cumulative capital investment of $12 billion and involve a work force of approximately 12,000 government (field) employees and approximately 100,000 contractor employees.

48745 (DOE/TIC—10133) **Second program plan for DOE's participation in the IEA Working Party on Energy Conservation Research and Development.** (Department of Energy, Washington, DC (USA)). Jan 1979. 77p. Dep. NTIS, PC A05/MF A01.

This program plan for DOE participation in the Working Party on Energy Conservation R and D covers DOE's FY 1979 commitments to the signed and new implementing agreements. The plan describes each implementing agreement and related annexes, including the tasks, project status, other participants in the agreement, and financial arrangements. Chapter 1 reviews current and planned DOE commitments to existing implementing agreements; Chapter 2 reviews planned DOE commitments to new implementing agreements. Appendix A explains how DOE commitments to IEA projects interact with the Federal budget cycle; Appendix B discusses the mechanisms for establishing implementing agreements and annexes; Appendix C is a list of the members of the Working Party on Energy Conservation R and D. The Working Party on Energy Conservation R and D is presently sponsoring work under implementing agreements in 9 areas: buildings and community systems; energy conservation in building complexes; energy cascading; heat pump systems; advanced heat pumps; combustion; heat transfer and heat exchangers; energy storage; cement manufacture. DOE has made commitments to all these agreements and is currently participating in 12 of the 13 annexes under way.

48746 (NP—23866) **1978 energy research and development inventory for the State of Missouri.** (Missouri Dept. of Natural Resources, Jefferson City (USA)). Jul 1978. 26p. TIC.

This inventory of current statewide energy related research and development projects was compiled in order to facilitate a more cohesive and well coordinated approach to energy problems. About 120 energy-related research projects are identified. Emphasis in research programs seem concentrated in electric, fossil fuels, and energy analysis and utilizations studies. Agriculture, nuclear energy, solar, and electric vehicles have also attracted considerable interest among Missouri researchers. Information on the organization sponsoring the research, the researcher, funding and amount, and time alloted are tabulated.

48747 (RAND/R—2481-DOE) **Review of cost estimation in new technologies: implications for energy process plants.** Merrow, E.W.; Chapel, S.W.; Worthing, C. (RAND Corp., Santa Monica, CA (USA)). Jul 1979. Contract EX-76-C-01-2337. 125p. Dep. NTIS, PC A06/MF A01.

Estimates of capital costs of pioneer energy process plants have been poor predictors of actual capital costs. Pre-design and early design estimates (even in constant dollars) have routinely understated definitive design estimates or ultimate costs by more than 100% for oil shale, coal gasification and liquefaction, tar sands, solid waste, and nuclear fuel reprocessing plants. This phenomenon of cost growth creates significant planning and management problems for both industry and the Department of Energy. For industry, cost growth has led to canceled plans, wasted costly design efforts, and in some cases significant losses when premature capital commitments have been made. For government energy officials, cost growth has made R and D allocation decisions difficult, has increased the uncertainty in supply planning, and has hampered commercialization planning efforts. This report reviews literature on cost estimation in several areas involving major capital expenditure programs: energy process plants, major weapons systems acquisition, public works and large construction projects, and cost-estimating techniques and problems for chemical process plants. One of the goals of this review was to aid in the development of a conceptual framework for the study.

48748 **Forging the links: a technology policy for Canada.** Ottawa, Ontario; Science Council of Canada (1979). 72p. Canadian Government Publishing Centre, Hull, Quebec, Canada K1A 0S9 $2.70.

The Canadian economy is faced with a serious crisis which is manifest in high unemployment, persistent trade imbalances, and a falling currency. These immediate problems reflect a deeper crisis in the structure of Canadian industry, and in particular, manufacturing, which precedes the recent recession in the Western economies. High levels of technological and managerial truncation, and relative technological backwardness have placed Canadian industry at a particular disadvantage in light of the substantial changes taking place in world economies. The advanced industrial nations are moving into more technologically advanced forms of production - the new industrial revolution. This trend threatens to outpace the innovative capacity of Canadian industry to such an extent that its manufactured products will no longer be competitive with those of principal trading partners. Further, a number of developing countries with lower labour costs are moving into many of the conventional areas of industrial activity (e.g., assembly manufacturing operations), thus threatening to displace a significant number of Canada's traditional manufacturing activities through increased price competition. A rebuilding of Canada's industrial structure as well as improving its technological capability is required. Implementation of such an industrial strategy would require four initial policy objectives: 1) increase the demand for Canadian technology within the industrial system; 2) expand Canadian industry's potential to develop technology; 3) strengthen the capacity for the absorption of technology at the level of the firm; 4) increase the ability of Canadian firms to import technology under conditions favourable to Canada.

48749 **Inventory of advanced energy technologies and energy conservation research and development: 1976—1978. Volume II. Prepared for the Committee on Science and Technology, U.S. House of Representatives, Ninety-Sixth Congress.** Washington, DC; Committee on Science and Technology (1979). 1364p. GPO.

This volume, Vol. II, inventories R and D in the following areas: chemistry; materials; engineering; geosciences; instrumentation; physics; nuclear physics; biomass production/conversion; synthetic and natural fuels; and electric power engineering. (MCW)

48750 **Inventory of advanced energy technologies and energy conservation research and development: 1976—1978. Volume I. Prepared for the Committee on Science and Technology, U.S. House of Representatives, Ninety-Sixth Congress.** Washington, DC; Committee on Science and Technology (1979). 778p. GPO.

A nationwide survey, conducted by the Energy R and D Inventory at Oak Ridge National Laboratory from September 1977 to April 1978, obtained information on over 14,800 energy and energy-related R and D projects in progress during the period from 1976 through 1978. Over 7,000 of these projects are concerned with research and development on advanced energy technologies and energy conservation. General information and statistical summary tables of funding and manpower are provided in this publication for each of these selected projects. Some information on all 14,800 projects is available on the Department of Energy's RECON (Remote Console) computer system. The inventory does not include fossil and nuclear research. Each of the 7,339 research project descriptions is listed in one of three volumes. This volume, Vol. I, compiles summaries of R and D in the following areas: solar and wind energy, geothermal energy, and hydro and tidal power (tidal power plants and wave energy converters). (MCW)

48751 **Inventory of advanced energy technologies and energy conservation research and development: 1976—1978. Volume III. Prepared for the Committee of Science and Technology, U.S. House of Representatives, Ninety-Sixth Congress.** Washington, DC; Committee on Science and Technology (1979). 1282p. GPO.

This volume, Vol. III, compiles summaries of R and D in the following areas: conversion (MHD generators, advanced automotive propulsion systems); energy management, energy policy, energy conservation; energy consumption; energy uses. (MCW)

NUCLEAR ENERGY

REFER ALSO TO CITATION(S) 48157, 48173, 48187, 48190, 48227, 48228, 48235, 48544

TRANSPORT AND STORAGE

REFER ALSO TO CITATION(S) 48875

48752 New fluid battery promises cheaper electricity storage. *Public Util. Fortn.;* **103**: No. 9, 65-66, 68(26 Apr 1979).

The REDOX energy storage system promises major cost reductions in the storing of electrical energy as well as long-term reliability and minimal environmental impact. The new NASA system could be scaled up in the next several years, depending on funding, to provide electric power companies with an efficient means of load leveling - the storing of thousands of kWh of energy during low demand periods for use later during periods of maximum power consumption. More immediately, REDOX systems in the kilowatt range could help to speed the growth of solar electric (photovoltaic) and wind-energy systems where the cost of electrical storage has been an important consideration since storage is necessary for the times the sun is not shining or the wind is not blowing.

WASTE HEAT UTILIZATION

REFER ALSO TO CITATION(S) 48321, 48322, 48862, 48863, 48864, 48865, 48867, 48868, 48871, 48872

48753 (DOE/NASA/1062—79/2) **Energy and cost savings results for advanced technology systems from the Cogeneration Technology Alternatives Study (CTAS).** Sagerman, G.D.; Barna, G.J.; Burns, R.K. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1979. Contract EC-77-A-31-1062. 23p. (NASA-TM—79213). Dep. NTIS, PC A02/MF A01.

An overview of the organization and methodology and a summary of selected results to date of the Cogeneration Technology Alternatives Study (CTAS) are presented. The objectives of the study are to identify the most attractive advanced energy conversion systems for industrial cogeneration applications in the 1985 to 2000 time period and to assess the advantages of advanced technology systems compared to those systems commercially available today. Advanced systems being studied include steam turbines, open and closed cycle gas turbines, combined cycles, diesel engines, Stirling engines, phosphoric acid and molten carbonate fuel cells and thermionics. Steam turbines, open cycle gas turbines, combined cycles, and diesel engines are also being analyzed in versions typical of today's commercially availably technology to provide a base against which to measure the advanced systems. Cogeneration applications in the major energy consuming manufacturing industries are being considered. Results of the study in terms of plant level energy savings, annual energy cost savings and economic attractiveness are presented for the various energy conversion systems considered. Sensitivity of the results to variations in assumed study groundrules such as fuel prices and the price of purchased electricity and the potential effect of regional characteristics are discussed.

CONSERVATION

REFER ALSO TO CITATION(S) 48750, 48751, 48766, 48786, 48814, 48817, 48818, 48824, 48825, 48827, 48831, 48834, 48847, 48857, 48863, 48874

48754 (COO—2893-9) **Energy optimal use of waste paper. Final report.** Gunn, T.L. (Illinois Univ., Urbana (USA). Office of Vice Chancellor for Research). Nov 1978. Contract EY-76-S-02-2893. 186p. Dep. NTIS, PC A09/MF A01.

In 1974, Americans consumed 65.5 million tons of paper. Of this, 12.1 million tons were recycled and 53.4 million tons were lost in use or became municipal solid waste. The paper which became solid waste could have been burned as a fuel or used as a raw material to make more paper. The report discussed what mix of burning and recycling of waste paper would minimize the total US energy used to make and dispose of the 1974 production of paper. Five cases are analyzed to determine the effects of various assumptions about how the energy in wood and paper will be treated. In one case, both wood and paper are assumed to have an energy value. In another, neither wood nor paper is assumed to have an energy value. In the other three cases, paper, but not wood, is assumed to have an energy value which is utilized differently in each case. It is found in each case that it is worthwhile in terms of energy conservation to recycle as much high-grade de-inking waste paper as can be collected. How much of the other grades of waste paper would be recycled depends on which of the various energy-accounting schemes is used. It is further found that the greatest energy savings are accomplished when both wood and waste paper are acknowledged to have an energy value. The greatest energy savings attainable in any case would be 30% of the energy actually used by the system in 1974.

48755 (DOE/TIC—10172) **Implementation plan for Alabama Energy Extension Service.** (Alabama Energy Management Board, Montgomery (USA)). 9 Dec 1977. Contract EC-77-G-01-5091. 111p. Dep. NTIS, PC A06/MF A01.

Exhibits are presented that describe the implementation plan for the state of Alabama's Energy Extension Service. Programs include areas of car care clinics, fuel substitution/utilization, boiler/water heater efficiency improvement program, efficient use of energy in agriculture, energy systems for low income groups, residential energy conservation information service program services and technical support, burning fuel more efficiently in the home. Information on these programs is presented in the following Exhibits: Program Services and Technical Support; Rate of Service Activity; Milestone Schedule, Quarterly Target Reports; Market Factors Feedback Plan; Budgets; and Publications/Materials. (MCW)

48756 (DOE/TIC—10173) **New Mexico EES Implementation Plan. Final version.** (New Mexico Energy Resources Board, Santa Fe (USA)). 20 Dec 1977. Contract EC-77-G-01-5093. 90p. Dep. NTIS, PC A05/MF A01.

Portions of document are illegible.

Seven exhibits are presented in this final implementation plan for New Mexico EES. The only major change from the original proposal is in the area of the budget in the agriculture, small business, and residential sectors. The exhibits are State EES Program and Technical Support, Rate of Service Activity, Market Factors Feedback Plan, Budget Table, Milestone Schedule, Quarterly Target Report, and Publications/Materials Schedule.

48757 (DOE/TIC—10177) **Washington Energy Extension Service Implementation Plan.** (Washington State Energy Office, Olympia (USA)). 9 Dec 1977. Contract EC-77-G-01-5097. 150p. Dep. NTIS, PC A07/MF A01.

A copy of the revised Washington State Energy Extension Service Implementation Plan is presented. Some specific information is presented for Seattle, Spokane, and Yakima program services and technical support.

48758 (DOE/TIC—10325) **National Association of Counties. Final report for the period July 1, 1976 through March 31, 1977.** (National Association of Counties, Washington, DC (USA)). 1977. 58p. Dep. NTIS, PC A04/MF A01.

This study was undertaken by the National Association of Counties Research Foundation to determine what effects thermal codes have had on counties. Public Law 94-385 requires states and localities to adopt, by 1981, thermal efficiency codes no less stringent than ASHRAE 90-75. The data assembled in this report supports three important conclusions: counties have the capacity to implement state energy codes on time and in a workmanship manner; the data is a composite of the experience obtained from field trips; and the dynamic nature of the energy conservation arena is shown. The need for fathering further information is indicated. Four exhibits are included: Selection Criteria, Monthly Reports, photocopies of written comments on the report, and a summary of Task Force meeting of September 1976 and March 1977. (MCW)

48759 Revised Missouri State Energy Conservation Plan. Jefferson City, MO; Missouri Energy Program (1978). 23p. (NP—23864).

In May 1977 the Missouri Energy Conservation Plan was submitted to the Federal government in accordance with the Energy Policy and Conservation Act 1975. In August 1977 the state submitted a supplemental energy conservation plan as a result of the Energy Conservation and Production Act of 1976. These two documents are the basis for energy conservation efforts in the state. Additional projects, such as the EES, are also being studied and implemented. These two components have been integrated within the revised Missouri Energy Conservation Plan to provide a foundation for a comprehensive state conservation program. This document provides a summary of each program measure included in the Base and Supplemental Plans as well as implementation strategies. The summary provides an overview of the total plan. The five mandated energy conservation measures required by EPCA and additional measures that are estimated to conserve 5.2% of the projected annual energy usage for 1980 are described. (MCW)

48760 Conservation as an energy resource: policy implications for California. Thompson, A.; Melendy, C.; Falk, J.; Bantz, T. Sacramento, CA; California State Energy Resources Conservation and Development Commission (1978). 68p. (NP—23835).

An aggressive and comprehensive energy conservation program for California has the potential to reduce the 1985 forecasted electrical and natural gas demand by 27.3 to 34.7 billion kWh's (13 to 17%) and 8 to 10.8 thousand MW's of summer peak electricity (18 to 25%), and by 2.4 to 2.8 billion therms of natural gas (18 to 21%). The conserved enegy constitutes a source of supply available for use throughout the state's economy and at a lower cost. Other objectives achieved through energy conservation are: positive effects on employment, reduced capital investment in electricity generation, reduced dependence on uncertain energy supplies, increased efficiency and cost-effectiveness of utility operations, minimization of stress on the environment, and slow-down in the use of nonrenewable resources. (MCW)

SUPPLY, DEMAND, AND FORECASTING

REFER ALSO TO CITATION(S) 48098, 48742, 48760, 48767, 48775, 48776, 48778, 48779, 48815, 48818, 48819, 48850

48761 (DOE/EIA—0184/1) **International energy assessment. Analysis report: AR/IA/79-27.** Kilgore, W.C. (Department of Energy, Washington, DC (USA). Energy Information Administration). May 1979. 75p. Dep. NTIS, PC A05/MF A01.

This paper provides a comprehensive assessment of the international energy situation between now and the year 1995 and includes the latest EIA forecasts of energy supply and demand for each region of the world. Also included are estimates of future world oil prices and a sensitivity analysis of the critical factors affecting those prices. The analysis projects that world energy consumption will rise at a rate of between 2.8 and 3.9% per year, over the forecast period, while the demand for petroleum is expected to grow at a rate of 2.0 to 3.5% per year. This growth in consumption is projected to occur during a period in which world economic activity is increasing at the rate of 3.8 to 4.6% per year, such that the estimated ratio of world energy growth to economic growth falls from its historic 1960—1976 ratio of 0.94, to a ratio of 0.71 to 0.85 over the 1976—1995 period. World oil prices are found to be highly uncertain with real prices by 1995 ranging between $16.50 and $31.50 per barrel across five projection series. The baseline price projections given in this paper assume that Iran's oil production returns to about 4 million barrels per day by the third quarter of 1979 and that current surcharges will be removed within the next year. The uncertainty on prices is shown to be even greater when one assumes either, more adverse pricing behavior on the part of OPEC, or, continued supply disturbnces such as those recently experienced in Iran. The principal tools used in the analysis are the International Energy Evaluation System (IEES) and the Oil Market Simulation (OMS) model.

48762 (DOE/EIA—0184/4) **Energy supply and demand in the short term: 1979 and 1980.** (Department of Energy, Washington, DC (USA). Energy Information Administration). Jun 1979. 128p. Dep. NTIS, PC A07/MF A01.

The report represents the short-term analysis contained in the EIA Annual Report to Congress, 1978. It provides overall energy supply and demand balances as well as a detailed discussion of the elements of end-use consumption of coal, natural gas, petroleum products, and electricity. In addition, it presents analyses of the operations of utilities and refineries, the domestic production of coal, natural gas, crude oil, and electricity and the supply and demand balances for each fuel. The first section deals with three topics: the analytical methodology; the sources of uncertainty; and, the major assumptions which underlie the three projection series to be presented. The overall energy balances are discussed in the next section. The following sections present the projections of the consumption and the supply of energy. The supply sections include projections of domestic production as well as supply and demand balances, synthetics and imports, and projections for the electric utility sector. The short-term energy projections are compared with those of the EIA Annual Report to Congress, 1977, and with those published by industry groups.

48763 (DOE/TIC—10657) **Propsed gasoline and diesel fuel rationing contingency plan. Contingency rationing regulations.** (Federal Energy Administration, Washington, DC (USA)). Apr 1977. 90p. Dept. NTIS PCA05/MF A01.

The contingency rationing plan, required by Section 203 of the Energy Policy and Conservation Act, if approved by the Congress, would remain in standby status unless the President finds that putting the plan into effect is required by a severe energy supply interruption or in order to fulfill obligations of the US under the international energy program and transmits such finding to the Congress, together with a statement of the effective date and manner for exercise of such plan. FEA will issue ration coupons and ration credits (ration rights) for each ration period equal to the total estimated supply of gasoline for the ration period. FEA would then distribute these ration rights through four basic programs. First, FEA would provide ration coupons to all eligible individuals. Second, FEA would provide ration credits to all firms which are engaged in priority activities for which a ration credit level has been established. These ration credits would be in addition to any ration coupons received by a person as an eligible individual. Third, FEA would distribute 3% of all ration rights through the State Hardship Reserves which would be used to meet the needs of certain specified users; e.g., handicapped persons, migrant workers, etc. Fourth, FEA would reserve 1% of the ration rights to distribute itself through the National Ration Reserve.

48764 Optimization model of the New Zealand energy supply and distribution system: summary report. Smith, B.R. Auckland, New Zealand; New Zealand Energy Research and Development Committee (1978). 15p. (NZERDC—42).

New Zealand's energy supply industry is becoming increasingly complex. There is growing interaction between the various sectors of the industry, with decisions made in one sector having ramifications in all other sectors. The analysis of energy options and policies therefore requires a simultaneous consideration of all sections of the supply industry. This research has been concerned with the development of a mathemtical programming model of New Zealand's energy supply, production, and distribution system. The model describes the steady-state operation of all sectors in the energy system for a given year. Forecast demand for energy is satisfied subject to various operational constraints. The optimality criterion is usually that of least cost, where this includes annuitized capital costs for plant and equipment, fuel costs, and also annual operation and maintenance costs. Demand is specified in terms of useful (effective) energy to the consumer. Several consumer categories are defined, allowing the consideration of features appropriate to individual categories as well as the process of inter-fuel substitution. Decision variables of the model include the levels of energy production, capacities of process plant and equipment (e.g. electricity generation stations), and the amount of each fuel type supplied to the various consumer demand categories. The methodology used is linear programming, with (in a limited number of cases) extensions to include nonlinear terms in the objective function. The model can be used to analyze a wide range of issues concerning energy production and use in New Zealand. Several studies on specific areas have been undertaken with the model; results and conclusions from a number of theses studies are described.

48765 Energy assembly. Albany, NY; Legislative Commission on Science and Technology (1978). 159p. (CONF-7805179—).

From An energy assembly; Albany, NY, USA (23 May 1978).

A transcript of the proceedings is presented in this report. Angelo F. Orazio, Legislative Commission on Energy Systems, presented the opening remarks. The focus of the meeting was on energy supplies and alternative energy sources for New York. Energy perspective for New York State was presented by Dr. Roland W. Schmitt. Energy strategy Options for New York State was presented by Dr. Martin Becker. A statement about the New York State Committee for Jobs and Energy Independence was made by Peter J. Brennan. The Executive Director of the New York State Committee for Jobs and Energy Independence, Dr. Robert Searby, presented the closing remarks. (MCW)

48766 Alternatives to oil and gas. Belding, J.A. (Energy Research and Development Administration, Washington, DC). pp 10.2.1-10.2.15 of C=me²: conservation = materials - environment - energy. Rolsten, R.F.; Sweeney, P.J. Dayton, OH; Wright Co. (1977).

From 3. international conference of environmental problems of the extractive industries-materials, energy and environment; Dayton, OH, USA (29 Nov 1977).

Faced with a critical shortage of oil and natural gas, it is generally agreed that the U.S. must turn to coal, nuclear, and solar. Economically attractive technologies are needed. To develop an energy strategy, the primary use sectors (electric utilities, transportation, industry, and residential/commercial) were analyzed. Given the technology options and driving/retarding forces in these market sectors, it was determined that a transition to alternate fuels should encompass two essential steps: (1) more-efficient use of currently available fuels; and (2) introduction of alternate fuels as they become available. A theoretical framework to analyze capital cost of conservation options compared to corresponding costs for energy-supply options at a particular time or stage of development is given, using fuel-cell technology as an example. Conservation will, therefore, become increasingly viable as fuel prices rise. The potential application of waste-heat utilization and fuel-cell technology are discussed. 12 references, 10 figures.

POLICY, LEGISLATION, AND REGULATION

REFER ALSO TO CITATION(S) 48103, 48124, 48125, 48128, 48228, 48267, 48751, 48774

48767 (DOE/EIA—0182/2) **1985, 1990, and 1995 Midterm Energy Market Model results under three scenarios of Fuel Use Act regulations.** Montgomery, W.D. III. (Department of Energy, Washington, DC (USA). Energy Information Administration). May 1979. 624p. Dep. NTIS, PC A99/MF A01.

The Council on Wage and Price Stability (COWPS) requested an analysis of the incremental impacts of the Powerplant and Industrial Fuel Use Act regulations as a function of the stringency of the economic test under which exemptions are granted. To carry out this analysis, EIA is utilizing the Mid-Term Energy Market Model (MEMM) to generate projections of energy supply, demand, and price under the specified assumptions. Industrial fuel demand is modeled by using a separate fuel-choise model to determine the share of oil, gas, and coal; these shares are then imposed on the MEMM solution. For electric utilities, impacts are modeled by altering the capital costs in the MEMM submodel. The purpose of this report is to transmit, without endorsement, preliminary numerical results of some of the model runs. The appendix provides results of nine MEMM runs based on regulatory scenarios and other assumptions supplied by COWPS. The results were reviewed to determine that the specified assumptions were implemented properly.

48768 (DOE/TIC—10448) **Task force on compliance and enforcement. Final report.** (Federal Energy Administration, Washington, DC (USA)). 13 Jul 1977. 90p. Dep. NTIS, PC A05/MF A01.

The report of Chairman Stanley Sporkin is presented. Thirteen basic findings and conclusions are reviewed in order to determine what new measures are called for. The Task Force initiated its discussions on May 13 and its efforts were organized into 5 major study areas. An overview of the FEA compliance and enforcement program was given and followed by summaries of recommendations on pending cases, compliance program organization, enforcement powers, compliance strategy, and audit staffing and techniques.

48769 (DOE/TIC—10480) **Private grievances and redress. Quarterly report, January 1, 1977—March 31, 1977.** (Federal Energy Administration, Washington, DC (USA)). 1977. 217p. Dep. NTIS, PC A10/MF A01.

During the period January 1 through March 31, 1977, five petitions for Special Redress Relief were received by the FEA. Actions and results on these cases are indicated. During the second quarter of 1977, the Office of Exceptions and Appeals resolved 574 cases by Decision and Order and dismissed 81 other cases. The Appendix discusses these cases indicating the facts involved in the case, the determination reached, and the basis for the decision.

48770 **Site reservation policies for large underground openings.** Duffaut, P. (AITES, Paris, France). *Underground Space;* **3**: No. 4, 187-193(Jan 1979).

The problems of coexistence between users of the underground are not restricted to the urban underground. For every kind of use, the concept of a suitable site has to be defined. As the best sites are limited, especially the largest sites, laws should be formulated to preserve and protect them. 9 references.

FOSSIL FUELS

48771 (FE/EES—79/5) **Bibliography of investment costs, operating costs, and related economic information for fossil-energy-related industries, January—December 1978.** Conley, L.A. (Department of Energy, Morgantown, WV (USA). Morgantown Energy Technology Center). Mar 1979. 42p. Dep. NTIS, PC A03/MF A01.

This report, covering the period January through December 1978, contains 169 abstracts of articles that deal with investment and operating costs, cost estimation methods and theory, developments in technology, and the status of construction projects. The abstracts are of articles from 22 journals. In addition, references are included to selected reports that have been issued through the National Technical Information Service, Springfield, VA. Most of the articles deal with investment and operating costs related to the development of fossil-energy sources. Coal-conversion and coal-mining costs are considered extremely important, since supplies of imported oil are uncertain and because costs of imported oil are rising.

COAL

REFER ALSO TO CITATION(S) 48094, 48098, 48259

48772 **Preliminary assessment of the radiological impact of western coal utilization.** Styron, C.E.; Robinson, B. (Mound Lab., Miamisburg, OH). pp 8.5.1-8.5.7 of C=me²; conservation = materials - environment - energy. Rolsten, R.F.; Sweeney, P.J. Dayton, OH; Wright Co. (1977).

From 3. international conference of environmental problems of the extractive industries-materials, energy and environment; Dayton, OH, USA (29 Nov 1977).

Western coal is expected to play an increasingly important role in meeting national energy needs, largely because of its abundance, accessibility, and low sulfur concentration. However, Western coal has been reported to have a relatively high uranium concentration. This research program was initiated to: (1) delineate the scope of the potential environmental and human health problem associated with radioactivity in Western coal; (2) establish a data base for ^{234}U, ^{238}U, ^{210}Pb, ^{210}Po, ^{230}Th and ^{226}Ra found in Western coal; (3) study the release, fate, and accumulation of radionuclides from a power plant burning Western coal; and (4) assess the possible need for additional control technology and/or standards. Preliminary results indicate that significant quantities of radionuclides are made available to the environment from burning Western coal. ^{210}Pb in coal used at the power plant averaged 0.79 pCi/g, and ^{210}Pb in/on vegetation in the environs of the power plant ranged from 2.23 to 5.70 pCi/g. Preliminary dose evaluations for ^{210}Pb alone indicated that individuals whose total vegetation intake was grown in this area could receive as much as 400 mrem/yr to the kidney. This compares to an average dose commitment to the kidney of 50 to 100 mrem/yr from natural levels of ^{210}Pb. Additional studies of ^{210}Pb concentrations in/on vegetation and of dose evaluations are being undertaken. It is important to note that the power plant has not been directly implicated as the sole source of these radionuclides in diffusion modeling studies. 16 references.

PETROLEUM

REFER ALSO TO CITATION(S) 48102, 48103, 48104, 48108, 48114, 48115, 48116, 48124, 48125, 48128, 48129, 48133

48773 **Constraints on the world oil monopoly price.** Adelman, M.A. (Massachusetts Inst. of Tech., Cambridge). *Resour. Energy;* **1**: No. 1, 3-19(Sep 1978).

The consuming nations have the power to damage or wreck the world oil monopoly, but prefer cooperation, because of their fixed belief that otherwise the market will fail to clear, and generate a gap. Yet they may use the power inadvertently. The monopoly acts essentially as a loose cartel with a safety net: a large seller (Saudi Arabia) could act as restrictor of last resort. But this would maximize Saudi profits at a much lower price, penalizing the other sellers. The conflict can be held off by ad hoc agreements while raising the price. But the risk of conflict and highly uncertain long-run demand and supply make it likely that the cartel will only slowly and gradually approach profit- or wealth-maximization. Political objectives coincide with economic and can be neglected. 12 references.

48774 **Gas-saving taxes: a comparison.** Seidel, M.R. (Dept. of Energy, Washington, DC). *Resour. Energy;* **1**: No. 1, 93-107(Sep 1978).

This paper makes a systematic micro-economic comparison of two excise taxes (on gasoline itself and on gas-using cars) as factors which alter both the purchase and the use of automobiles. If car use is partially elastic with respect to gasoline costs, then the gas tax is much more effective in reducing the use of gasoline. For the lifetime fuel consumption of one year's new cars to be reduced 16% would require a 10-cent gas tax and a net social cost of about $140 million; to achieve this reduction with a tax on cars would incur a net social cost of $1.23 billion. the added costs appear largely as congestion and pollution effects due to additional vehicle-miles traveled.

NATURAL GAS

REFER ALSO TO CITATION(S) 48103, 48108, 48135, 48138, 48144, 48743

HYDROGEN AND SYNTHETIC FUELS

REFER ALSO TO CITATION(S) 48254, 48260, 48883

ELECTRIC POWER

REFER ALSO TO CITATION(S) 48269, 48771

48775 (EPRI-EA—1035-SR, pp 2.1-2.12) **PSE & G method for forecasting residential kilowatthour consumption. Section 2.** Comerford, R.B. (Public Service Electric & Gas Company, Newark, NJ). Mar 1979.

From EPRI symposium on how electric utilities forecast; New Orleans, LA, USA (7 Dec 1977).

The philosophy and general forecasting framework used by the Public Service Electric and Gas Company (PSE and G) of New Jersey to project residential electricity consumption is described. Three specific methods are used: (1) a series of econometric equations covering both heating and non-heating customers, (2) an appliance saturation and use model, and (3) a survey of regional marketing specialists. Each method is evaluated for its strengths, weaknesses, and predictability. The historical use of simple trend lines is shown to be inadequate with today's need for accurate forecasts on which to base utility decisions.

48776 (EPRI-EA—1035-SR, pp 3.1-3.6) **Common-sense approach to forecasting. Section 3.** Thomas, B. (Puget Sound Power & Light Co., Bellevue, WA). Mar 1979.

From EPRI symposium on how electric utilities forecast; New Orleans, LA, USA (7 Dec 1977).

The forecasting process is divided into two functions: (1) the point estimate, which is the true forecast; and (2) the forecast analysis, which qualifies and identifies probable ranges. The most-probable point estimates, then, have eliminated ambiguities. Reasonable forecasting should be motivated by a need for the most probable future outcome rather than to justify preconceived ideas or prior decisions - an approach which can influence the choice of model, variables, and relationships to get the desired end result. Utility forecasters are advised not to become so enamored of their forecasting methodologies that they overlook the role of subjectivity in selecting their data and assumptions.

48777 (EPRI-EA—1035-SR, pp 8.1-8.26) **Mathematical model for estimating the effects of imposing time-of-use rates. Section 8.** Anderson, K.P. (National Economic Research Associates, Inc., Los Angeles, CA). Mar 1979.

From EPRI symposium on how electric utilities forecast; New Orleans, LA, USA (7 Dec 1977).

A model is described which can help decision makers evaluate what the potential effects will be if time-of-day rates are imposed on customers of the Public Service Company of Colorado (PSCC). The limited information available on price elasticity is summarized in terms of the potential effect of pre-existing two-part rates on time-of-day responsiveness. The results indicate that peak shifting is less likely if price elasticities are low during the short term.

48778 (EPRI-EA—1035-SR, pp 9.1-9.10) **Methodology for forecasting commercial kilowatthour consumption at Consolidated Edison. Section 9.** Carlton, R.W. (Consolidated Edison Company of New York, Inc., NY). Mar 1979.

From EPRI symposium on how electric utilities forecast; New Orleans, LA, USA (7 Dec 1977).

Consolidated Edison, which provides 8.3 million people in a 600-square-mile area with electric power, sells 55% of its power to the combined commerical and small industrial sector. Marked changes have taken place in forecasting after 1971, when the trending method became unreliable because of conservation efforts by the utility. Large rate increases in 1973, a national recession, and a lack of local commercial data further complicated forecasting. Present near-term forecasts continue to rely on trends, supplemented by various modeling techniques. Long-term forecasts for the commercial sector extend the short-term growth rates after allowing for disturbances in the business cycle.

48779 (EPRI-EA—1035-SR, pp 10.1-10.8) **Methodology for forecasting commercial and small-industrial kilowatthour sales. Section 10.** Edwards, J.M. (Houston Lighting and Power Co., TX). Mar 1979.

From EPRI symposium on how electric utilities forecast; New Orleans, LA, USA (7 Dec 1977).

Models developed by the economic research staff of Houston Lighting and Power Company to forecast commercial and small industrial power demand are described. Although the customer class is heterogeneous, modeling methods have been developed to overcome this obstacle. The models are econometric, using standard multiple linear-regression analysis to explain kilowatthour use as a function of economic variables. The five-step forecasting process is summarized and its application to short-term and long-term forecasting is evaluated.

48780 (EPRI-EA—1035-SR, pp 14.1-14.11) **Forecasting problems of the municipal utility. Section 14.** Ward, A.G. (Middle West Service Co., Chicago, IL). Mar 1979.

From EPRI symposium on how electric utilities forecast; New Orleans, LA, USA (7 Dec 1977).

Small utilities, such as the municipal utility of Naperville, IL, have no forecasting staff and must call in consultants from a larger utility. They also concentrate on short-term forecasting because their budgeting is on an annual basis. An unusual five-year forecast was made for the Chicago suburb that used historical data and regression analysis. Data-gathering methods and problems are described and it is evident that forecasting for small utilties is complicated by a data base that is too small for the econometric computer model.

48781 (EPRI-EA—1035-SR, pp 15.1-15.6) **Industrial demand for electricity. Section 15.** Trimnell, F.O. (Ontario Hydro, Canada). Mar 1979.

From EPRI symposium on how electric utilities forecast; New Orleans, LA, USA (7 Dec 1977).

Econometric modeling of Ontario Hydro's 109 direct industrial customers is being used to determine the effect of electricity rate structure on power consumption without separating the two functions of peak kilowatt consumption and kilowatthour consumption. The study investigated actual customer load curves and found that the number of plant shifts determined the load shape. Load-flattening incentives will concentrate on the variables affecting load factor rather than just peak demand. The study will be completed in 1979.

48782 (EPRI-EA—1035-SR, pp 16.1-16.8) **Forecasting large commercial and industrial kilowatt and kilowatthour consumption, including sales for resale. Section 16.** Lamers, C.J. (Wisconsin Public Service Corp., Green Bay). Mar 1979.

From EPRI symposium on how electric utilities forecast; New Orleans, LA, USA (7 Dec 1977).

Long-term forecasting by large utilities can be a complex process, consuming up to two man-years for a 20-year forecast. The portion of the Wisconsin Public Service Corporation's forecast that deals with large commercial and industrial customers and those customers buying energy for resale is described. Changes in forecasting philosophy for this group have taken place in recent years because of the size of their demand, the impact of their conservation and fuel-conversion efforts, the potential for customer-owned or topping generators, and other factors. Each of the customers was asked by the Electric Load Forecast Committee to prepare its own 20-year forecasts on the basis of a list of assumptions about energy availability, electricity price, fuel prices, economics, and rate structure reform. Total forecast results from analyzing this information proved to be very accurate.

48783 **Load controls and equipment for using off-peak energy.** Cambridge, MA; Arthur D. Little, Inc. (1979). 274p. (NP—22575). Electric Power Research Inst., Palo Alto, CA.

Specific electrical load management programs established by ten utilities in the US, three utility thermal storage experiments and three 2-way utility communication systems are described. The ten utility programs analyzed included control of three residential loads (water heating, space heating, and air conditioning) and irrigation pump motors. The purpose, operating procedures, incentives to participating customers, equipment employed, costs and any special characteristics for each of the ten load management programs are described. Each utility has provided an assessment of its program performance and current program plans. The three utility thermal storage experiments are essentially proof-of-concept tests. In each case at least one house has been constructed with a reservoir for storing hot water, cold water, or ice. The discussion of these experiments is brief. The new two-day utility communication systems described are designed for remote time-of-day metering applications, monitoring and control of distribution systems and customer load control. Each system, its components and capabilities, and manufacturers' estimates of component costs are discussed.

48784 **Smooth approximation and forecasting of load-duration curves.** Uri, N.D. (Dept. of Energy, Washington, DC); Maybee, J.S. *Electr. Power Syst. Res.;* **1**: No. 4, 255-259(Dec 1978).

This paper develops a methodology for forecasting a load-duration curve. The approach adopted is to estimate a load-duration curve as a combined linear-exponential function and relate the coefficients of this function to a set of economic and weather-related variables. This relationship allows one to forecast the coefficients which are in turn used to provide a forecast of the coefficients of interest. The model presented, for a specific set of data, forecasts well, and presents a substantial improvement over existing approaches to obtaining future load-duration curves.

ELECTRIC POWER GENERATION

REFER ALSO TO CITATION(S) 48262, 48749

48785 (ORAU/IEA—78-16(M)) **Rethinking the scale of coal-fired electric generation: technological and institutional considerations.** Gilmer, R.W.; Meunier, R.E.; Whittle, C.E. (Institute for Energy

Analysis, Oak Ridge, TN (USA)). Apr 1978. Contract EY-76-C-05-0033. 69p. Dep. NTIS, PC A04/MF A01.

This paper examines the economic and social implications of an electric-utility system based on medium-scale (50 to 200 MWe) coal-fired plants dispersed near load centers. The historical trend in US electric generation has been a sustained effort to capture the economies of large scale. Technical and institutional conditions within the industry, as well as the historical perception of universal electrification as a desirable social goal, have brought about this trend. Large fossil and nuclear plants, often representing joint ventures of several utilities, dominate the plans of utilities over the next 20 years. Despite these trends, this review was unable to conclude that clear advantages must inherently accrue to either small- or large-scale electrical generation. Transportation and construction do offer demonstrable economies of scale, but the other terms in the cost equation (such as reliability and transmission) are sufficiently uncertain or site-specific to prevent firm conclusions concerning the effect of scale. Biases believed to exist in the regulatory process would dilute the utilities' perception of any advantages accruing to small generators; rate-of-return regulation favors overcapitalization as embodied in the construction of large plants and extensive transmission networks. It is not clear that the current regulatory structure is capable of weighing the institutional values of accountability and local control against dollar savings generally supposed to accrue to large plants. The Midwest and East North Central states may be singularly fit for a decentralized, medium-scale system for historical, geographical, and institutional reasons, as well as for their location near the coal fields.

ELECTRIC POWER TRANSMISSION AND DISTRIBUTION

REFER ALSO TO CITATION(S) 48541

CONSUMPTION AND UTILIZATION

REFER ALSO TO CITATION(S) 48751, 48766, 48841, 48849, 48856, 48874

48786 Estimating the effects of the onset of the energy crisis on residential energy demand. Mayer, L.S. (Princeton Univ., NJ). *Resour. Energy;* **1**: No. 1, 57-92(Sep 1978).

The onset of the energy crisis as indicated by the start of the Arab oil embargo gave both the private and public sector incentive to reduce the domestic demand for natural gas and oil. Through several mechanisms the residential consumer was encouraged to reduce the demand for energy in the home. A community of almost-identical owner-occupied townhouses is examined to assess the degree to which these mechanisms were effective. The homogeneity of the community removes many sources of variation that would plague an analysis of a random sample of American homes. The demand for natural gas, a fuel used only for space heating in the townhouses, was reduced significantly, but the demand for electricity was unaffected by the onset of the crisis.

UNCONVENTIONAL SOURCES AND POWER GENERATION

REFER ALSO TO CITATION(S) 48750, 48765, 48883

SOLAR

REFER ALSO TO CITATION(S) 48104, 48265, 48266, 48267, 48268, 48269, 48280, 48303, 48311, 48321, 48322, 48334

48787 (HCP/M4131—01, pp 415-421) **Policy, decision making, financing and engineering issues in solar energy applications, Germantown Campus, Montgomery Community College.** Dueber, E.A. Nov 1978.

From Second solar heating and cooling commercial demonstration program contractor's review; San Diego, CA, USA (13 Dec 1978).

This paper will deal with a solar collection system recently completed for Montgomery College but not from a technical standpoint - the system is very straightforward - nor from a performance base, as it has not been in operation long enough to acquire meaningful data. Rather, it will present the decision making process that led to the approval and funding of an expenditure of $322,000 in public funds that is not expected to begin to pay off before the public officials involved will have been long out of office.

GEOTHERMAL

REFER ALSO TO CITATION(S) 48505

OTHER

REFER ALSO TO CITATION(S) 48259, 48260, 48509, 48749

ENERGY CONVERSION

REFER ALSO TO CITATION(S) 48751

48788 Energy conversion in the context of the origin of life. Oro, J. ((Univ. of Houston, TX); Miller, S.L.; Urey, H.C. pp 7-19 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

The following topics are discussed: gravitational contraction and thermonuclear fusion as the two major primary sources of energy in the universe; organic compound synthesis; energy sources; highly ionizing radiation; thermal quenching from volcanoes and shock waves; ultraviolet light as a source of energy; electric discharges; Fischer—Tropsch reactions and heterogeneous catalysis; and low temperature condensation reactions. (HLW)

MHD GENERATORS

DESIGN AND DEVELOPMENT

48789 Process and equipment for magneto-hydrodynamic energy generation with MHD generators fired with fuel. Dardai, P.; Meckl, F.; Papp, J.; Varga, E. (to Banyaszati Kutato Intezet, Budapest (Hungary); Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,711,189/A/. 21 Sep 1978. 14p. (In German).

The object of the invention is the magneto-hydrodynamic generation of energy in MHD systems fired with fuel, where the fuel is first burnt and the combustion products are taken in ionised form to an MHD generator. The ionisation of the combustion products by shock waves is claimed, which is produced by the explosion of added explosive materials. The explosive material is ignited by a laser beam. The combustion chamber is made in the form of a hollow resonator with parabolic walls. A control unit ensures fuel supply, combustion, supply of explosive material and ignition in a predetermined sequence.

48790 Method of foaming a liquid metal. Fischer, A.K.; Johnson, C.E. (to Dept. of Energy). US Patent Application 929,144. 28 Jul 1978. 10p.

A method for promoting the formation of a foam and for improving bubble retention and foam lifetimes in liquid metal NaK or sodium used to generate power in two-phase liquid metal MHD generators is described. In a two-phase liquid metal MHD generator, a compressed, hot, inert gas is used as the thermodynamic working fluid to electrically drive a conductive liquid metal such as NaK, sodium or tin through the generator channel. The gas and liquid are mixed together just as the mixture enters the generator channel so that the expansion of the gas drives the conductive liquid across the magnetic field, generating electrical power. The two phases are then separated and returned to the mixer through different loops.

PERFORMANCE AND TESTING

48791 (COO—4049-5) **Operation and maintenance of ERDA/PERC two-stage MHD pressurized coal combustor. Quarterly activity report, July 1, 1977—September 30, 1977.** (Management and Technical Services Co., Bruceton, PA (USA)). 20 Oct 1977. Contract EY-76-C-02-4049. 17p. Dep. NTIS, PC A02/MF A01.

The installation and performance testing of a 1000 lb/hr coal dryer are described in detail. Run No. 9 was then run in the combustor. Various problems encountered are discussed, including the buildup of slag on the cyclone floor, so that the slag tap hole had to be cleared with a paper. Post-test examination is described and it was decided to replace the water-cooled cyclone bottom with a refractory bottom. This was later modified by adding water cooling coils to control the temperature more precisely. Difficulties in attaining the desired particle size of pulverized coal are discussed. (LTN)

MATERIALS, COMPONENTS, AND AUXILIARIES

REFER ALSO TO CITATION(S) 48789, 48801, 48802, 48803

48792 (COO—4049-2) **Operation and maintenance of ERDA/PERC two-stage MHD pressurized coal combustor. Quarterly activity report, 1 October 1976—31 December 1976.** (Management and Technical Services Co., Bruceton, PA (USA)). 6 Jan 1977. Contract EY-76-C-02-4049. 11p. Dep. NTIS, PC A02/MF A01.

48793 (COO—4049-3) **Operation and maintenance of ERDA/PERC two-stage MHD pressurized coal combustor. Quarterly activity report, 1 January 1977—31 March 1977.** (Management and Technical Services Co., Bruceton, PA (USA)). 27 Apr 1977. Contract EY-76-C-02-4049. 19p. Dep. NTIS, PC A02/MF A01.

48794 (COO—4049-4) **Operation and maintenance of ERDA/PERC two-stage MHD pressurized coal combustor. Quarterly activity report, 1 April 1977—30 June 1977.** (Management and Technical Services Co., Bruceton, PA (USA)). 1977. Contract EY-76-C-02-4049. 16p. Dep. NTIS, PC A02/MF A01.

48795 (COO—4049-6) **Operation and maintenance of ERDA/PERC two-stage MHD pressurized coal combustor. Quarterly activity report, October 1—December 31, 1977.** (Management and Technical Services Co., Bruceton, PA (USA)). 27 Jan 1978. Contract EY-76-C-02-4049. 15p. Dep. NTIS, PC A02/MF A01.

Runs 12, 13, 14, and 15 in the combustor are described. Various difficulties (coal blockage, slag solidification over the tap hole, human damage due to excessive temperature, etc.) are described. The unit was modified so that it could be started with fuel oil or propane and then coal or coal/fuel oil fed. (LTN)

48796 (COO—4049-7) **Operation and maintenance of DOE/PERC 100 hp coal slurry facility. Quarterly activity report, January 1, 1978—March 31, 1978.** (Management and Technical Services Co., Bruceton, PA (USA)). 26 Apr 1978. Contract EY-76-C-02-4049. 14p. Dep. NTIS, PC A02/MF A01.

Various problems encountered in Runs 15 and 16 are described. The modifications made as a result of these problems are discussed. (LTN)

48797 (COO—4049-8) **Operation and maintenance of DO/PERC two-stage MHD pressurized coal combustor. Quarterly activity report, April 1, 1978—July 14, 1978.** (Management and Technical Services Co., Bruceton, PA (USA)). 7 Aug 1978. Contract EY-76-C-02-4049. 15p. Dep. NTIS, PC A02/MF A01.

Run No. 17 is discussed in some detail. The test was stopped due to overheating of the cyclone floor (stopped before much damage occurred). Various problems are discussed and the modifications made in response to them are described. Deposits were cleaned from parts of the system and new instrumentation was installed. (LTN)

48798 (COO—4049-10) **Operation and maintenance of DOE/PERC two-stage MHD pressurized coal combustor. Quarterly activity report, July 15, 1978—September 30, 1978.** (Management and Technical Services Co., Bruceton, PA (USA)). 30 Oct 1978. Contract EY-76-C-02-4049. 10p. Dep. NTIS, PC A02/MF A01.

48799 (COO—4049-11) **Operation and maintenance of DOE/PERC two-stage MHD pressurized coal combustor. Quarterly activity report, October 1, 1978—December 31, 1978.** (Management and Technical Services Co., Bruceton, PA (USA)). 31 Jan 1979. Contract EY-76-C-02-4049. 8p. Dep. NTIS, PC A02/MF A01.

DUCT ENGINEERING AND FLUID DYNAMICS

48800 Method of fabricating thermoelectric power generator modules. Niculescu, V. US Patent 4,149,025. 10 Apr 1979. Filed date 16 Nov 1977. 10p.

An improved method of fabricating thermoelectric power generator modules, which are particularly useful in converting solar energy into electrical power and heat, is disclosed. This method involves the formation of an array of longitudinally elongated n- and p-type semiconductor elements tightly contained in a supporting matrix; slicing the supporting matrix containing the semiconductor elements to provide a plurality of matrix plates; and the application of a pattern of electrically conductive pads on opposite surfaces of the matrix plates to connect n- and p-type semiconductor elements, in series, thereby forming a thermoelectric power generator module. This method is simpler, less expensive and more adaptable to large scale production than methods heretofore proposed.

48801 Magnetohydrodynamic generator electrode. Marchant, D.D.; Killpatrick, D.H.; Herman, H.; Kuczen, K.D. (to Dept. of Energy). US Patent 4,140,931. 20 Feb 1979. Filed date 8 Aug 1977. 6p.

PAT-APPL-822,971.

An improved electrode for use as a current collector in the channel of a magetohydrodynamid (MHD) generator utilizes an elongated monolithic cap of dense refractory material compliantly mounted to the MHD channel frame for collecting the current. The cap has a central longitudinal channel which contains a first layer of porous refractory ceramic as a high-temperature current leadout from the cap and a second layer of resilient wire mesh in contact with the first layer as a low-temperature current leadout between the first layer and the frame. Also described is a monolithic ceramic insulator compliantly mounted to the frame parallel to the electrode by a plurality of flexible metal strips.

48802 Magnetohydrodynamic electrode. Boquist, C.W.; Marchant, D.D. (to Dept. of Energy). US Patent 4,128,776. 5 Dec 1978. Filed date 29 Nov 1976. 6p.

PAT-APPL-745,942.

A ceramic-metal composite suitable for use in a high-temperature environment consists of a refractory ceramic matrix containing 10 to 50 volume percent of a continuous high-temperature metal reinforcement. In a specific application of the composite, as an electrode in a magnetohydrodynamic generator, the one surface of the electrode which contacts the MHD fluid may have a layer of varying thickness of nonreinforced refractory ceramic for electrode temperature control. The side walls of the electrode may be coated with a refractory ceramic insulator. Also described is an electrode-insulator system for a MHD channel.

48803 Ceramic component for electrodes. Marchant, D.D. (to Dept. of Energy). US Patent Application 915,419. 14 Jun 1978. 10p.

A ceramic component suitable for preparing MHD generator electrodes consists of HfO_2 and sufficient Tb_4O_7 to stabilize at lease 60 volume percent of the HfO_2 into the cubic structure. The ceramic component may also contain a small amount of PrO_2, Yb_2O_3 or a mixture of both to improve stability and electronic conductivity of the electrode. The component is highly resistant to corrosion by molten potassium seed and molten coal slag in the MHD fluid and exhibits both ionic and electronic conductivity.

PERFORMANCE AND TESTING

REFER ALSO TO CITATION(S) 48731

FUEL CELLS

REFER ALSO TO CITATION(S) 48766, 48804

DESIGN AND DEVELOPMENT

48804 (AD-A—061242) **OPtimization of Pt-doped Kocite (trade name) electrodes in H3Po4 fuel cells. Interim progress report No. 5, 28 January-28 July 1978.** Welsh, L.B.; Leyerle, R.W.; Preston, D.M. (UOP, Inc., Des Plaines, IL (USA)). Aug 1978. Contract DAAG53-76-C-0014. 54p. NTIS PC A04/MF A01.

The use of UOP Inc. Kocite electrocatalysts as low-cost air and/or fuel electrocatalysts in phosphoric acid electrolyte fuel cells is being optimized with respect to some of the electrocatalyst and electrode structure parameters. Kocite electrocatalysts are made from Kocite materials, which are composite structures consisting of pyropolymers chemically bonded to refractory substrates. Fuel cell electrodes are fabricated from these electrocatalysts and normally tested as anodes and cathodes in model fuel cells.

48805 Fuel cell power plant and method for operating the same. Sederquist, R.A. (to United Technologies Corp., Hartford, CT). US Patent 4,128,700. 5 Dec 1978. Filed date 26 Nov 1977. 10p.

In a fuel cell power plant the anode and cathode exhausts are combined and burned in a burner with a first portion of the burner exhaust being delivered into fuel conditioning apparatus to provide the heat for converting a carbonaceous fuel to hydrogen. The hydrogen is then fed to the anode side of the fuel cells. A second portion of the burner exhaust is preferably used to drive a turbocharger for compressing the fuel cell oxidant which is usually air. If the fuel cells do not operate on pressurized reactants, then the energy in the second portion of the burner exhaust can be used for any other suitable purpose.

48806 Hydrogen—chlorine electrochemical energy storage system. Hart, T.G. (to Energy Development Associates). US Patent 4,124,741. 7 Nov 1978. Filed date 4 Mar 1977. 6p.

A HCl electrochemical energy storage system comprises a cell having an aqueous HCl electrolyte in which at least a portion of the HCl is present in disassociated form and an electrode of upgraphitized carbon. Communicating with the cell is at least one member of the group of means for storing hydrogen and means for storing chlorine. The means for storing hydrogen comprises graphitized carbon, and the means for storing chlorine comprises ungraphitized carbon.

48807 Fuel battery in filter press construction. Kohlmueller, H. (to Siemens A.G., Berlin (Germany, F.R.); Siemens A.G., Muenchen (Germany, F.R.); Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,316,067/B/. 3 Aug 1978. 8p. (In German).

Addition to P2026220.8.

In fuel cell batteries of filter press type construction for liquid electrolytes and at least one gaseous reaction material, as described

in main patent De-OS 20 26 220, the gas or electrolyte space of individual fuel elements containing the electrodes or supporting frameworks are separated by asbestos diaphragms with edge zones which are thickened. The difficulties found in using components with certain tolerances were overcome, according to the invention, by making the width of the part of the edge zone on the electrolyte side of the central part smaller than the width of the part on the gas side and having the supporting frameworks or electrodes arranged in the electrolyte spaces project in area beyond the inner edge of the part of the edge zone on the gas side.

PERFORMANCE AND TESTING

REFER ALSO TO CITATION(S) 48731

MATERIALS, COMPONENTS, AND AUXILIARIES

48808 (BM-RI—8341) **Platinum-substitute materials as electrocatalysts for oxygen reduction.** Cathey, W.N.; Nicks, L.J.; Bauer, D.J. (Bureau of Mines, Reno, NV (USA). Reno Metallurgy Research Center). 1979. 21p. Bureau of Mines, Washington, DC.

Many materals including carbides, silicides, phosphides, borides, nitrides, oxides, and metals were studied by the Bureau of Mines as potential fuel cell catalysts for electroreduction of oxygen in 1N H_2SO_4 electrolyte. The objective of this study was to assess the potential of abundant, low-cost materials as substitutes for platinum or to increase the catalytic efficiency of platinum. Several compounds were rejected because of their reaction in the corrosive environment of the oxygen electrode. However, some of the remaining were the most active catalysts. Activity of carbides such as tungsten carbide could be improved by doping with platinum-group metals, by varying stoichiometry, or by sputterng on a layer of platinum. While no catalysts were found with activity as high as platinum, some compounds were shown to be deserving of further investigation.

48809 **Thermal regulation of electrochemical energy generators (fuel cells).** Gurevich, I.G.; Fayngol'd, L.A.; Shchitnikov, V.K. pp 36-37 of Problemy teplo- i massoobmena - 77. Minsk, BSSR; Akademiya Nauk (1977). (In Russian)

An analysis is made of existing systems for thermal regulation of electrochemical energy generators, and their advantages and disadvantages are determined. It is shown that a promising unit for use in some electrochemical energy generator designs is a thermal regulation system based on using the principle of a gas-controlled two-phase heat siphon with its inherent absence of external energy consumption for heat transfer and the possibility of making heat exchange surfaces with a high degree of isothermality (due to operation under conditions of developed bubbling boiling). An experimental study of such a system is done under conditions of self-regulation and external regulation as applied to the probable conditions of operation of the electrochemical energy generator. Based on the example of coolants of organic origin (ether, ethanol, methanol), an investigation is made of the influence that the physical properties of the latter have on the thermostatting properties of the heat control system. It is shown that this characteristic of the system is related in a complex way to the slope of the vapor saturation curve, the thermostatting level and the parameters of operating conditions of the electrochemical energy generator. For a heat siphon that operates in the self-regulatory mode, quantitative characteristics are found for the thermostatting parameter (accuracy of maintaining temperature of the electrochemical group of the fuel cell) as a function of the amount of heat release (current loads on the fuel cell) and the temperature of the coolant in the heat-waste loop. A relation is established between this parameter and the structural parameters of the heat siphon.

48810 **Electrolyte—cathode assembly for a fuel cell.** Van den Berghe, P.; Tannenberger, H. US Patent 4,142,024. 27 Feb 1979. Priority date 28 May 1976, Switzerland, 6p.

An electrolyte cathode assembly for a solid electrolyte fuel cell intended for operation at high temperature comprises a solid ceramic electrolyte gas-tight body which is capable of conducting oxygen ions, the electrolyte having in contact with it and secured to its surface a layer of electron-conducting material which is a compact layer made up of a mixture of doped indium oxide In_2O_3 and a ceramic material which is capable of conducting both oxygen ions and electrons at the cell operating temperature, the said layer being covered with a surface layer, which is permeable to gas, of doped indium oxide In_2O_3 having a dendritic structure.

48811 **Catalyst and method for making.** Jalan, V.M.; Bushnell, C.L. (to United Technologies Corp.). US Patent 4,137,372. 30 Jan 1979. Filed date 23 Nov 1977. 8p.

The rate of platinum recrystallization of a platinum supported on carbon catalyst is reduced by depositing porous carbon on and around the supported platinum crystallites. The reduced rate of platinum recrystallization results in higher platinum surface areas over a period of time and therefore improves the performance of the catalyst. The porous carbon can be deposited by any suitable technique, a preferred method being to heat the supported platinum in the presence of carbon monoxide to decompose the carbon monoxide thereby depositing carbon on and around the platinum crystallites.

48812 **Electrolyte-cathode assembly for a fuel cell.** Van Den Berghe, P.; Tannenberger, H. US Patent 4,130,693. 19 Dec 1978. Priority date 28 May 1976, Switzerland, 6p.

An electrolyte cathode assembly for a solid electrolyte fuel cell suitable for operation at high temperatures comprises a gas-tight body made of a solid ceramic electrolyte which is capable of conducting oxygen ions having in contact with it and secured to it a layer of electron-conducting material which is a mixture of doped indium oxide In_2—O_3 and a ceramic material which is capable of conducting oxygen ions at the cell operating temperature, the said layer being covered by a compact surface layer of a ceramic material which is capable of conducting both electrons and oxygen ions.

48813 **Fuel cell structure.** Damiano, P.J. (to United Technologies Corp., Hartford, CT). US Patent 4,129,685. 12 Dec 1978. Filed date 15 Aug 1977. 10p.

In a stack of electrochemical cells, such as fuel cells, distinct channels behind each electrode for carrying reactant gas are eliminated by using highly porous gas distribution layers, such as porous electrode substrate material. This gas distribution layer must be sufficiently thick and have enough pores sufficiently large to permit a substantially free flow of reactant gas therethrough both perpendicular to and parallel to the catalyst layer.

ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 48751, 48766

48814 (NP—23760) **Tennessee Energy Extensive Service implementation plan.** Collins, N.E. (Tennessee Univ., Knoxville (USA). Environment Center). 12 Dec 1977. 68p. NTIS, PC A04/MF A01.

Tables and charts are presented which summarize the services to be provided by the Tennessee Energy Extension Service, the customers to be served, financing, evaluation, and the projected time schedules for program implementation. (LCL)

BUILDINGS

48815 (DOE/TIC—10365) **Proposed energy conservation contingency plan: emergency restrictions on outdoor gas lighting. Authorities need, rationale, operation.** (Federal Energy Administration, Washington, DC (USA)). Apr 1977. 25p. Dep. NTIS, PC A02/MF A01.

The test of the Plan is presented and the need, rationale, and operation of the plan are discussed. The restrictions on outdoor natural gas lighting contained in the plan were selected following a careful analysis of safety and security considerations. Street and highway lights are not included in the restrictions due to their importance in reducing the potential for crime and motor vehicle accidents.

48816 (DOE/TIC—10369) **Impact of state mandated thermal efficiency standards on counties.** (National Association of Counties, Washington, DC (USA)). Mar 1977. 76p. Dep. NTIS, PC A05/MF A01.

A study to determine what effect the implementation of state mandated Thermal Efficiency Codes has had, if any on counties is discussed. In July 1976, there were 19 states with authority to regulate energy use through the regulation of the design and the construction of new buildings. In 16 states a state-wide building code was a vehicle for energy regulations. Three states (California, Nevada, and New York) have energy regulations separate from state-wide building code authority. Five counties selected for study are: Lane County, Oregon; Mecklenburg County, North Carolina; Montgomery County, Maryland; Sacremento County, California; and Washington County, Minnesota. The energy situation in each state was examined to reveal supply and consumption patterns and shortages, if any. It is concluded that counties that have a building code and an experienced staff can accommodate and energy code which establishes certain standard practices as a minimum.

48817 (DOE/TIC—10545) **Market analysis and program for use for energy conservation manuals: a marketing plan. Final report.** (Federal Energy Administration, Washington, DC (USA)). 25 Feb 1977. 245p. Dep. NTIS, PC A11/MF A01.

The FEA, with a mission to analyze total national energy usage, formulate policy, and stimulate actions that will increase domestic energy supply and decrease energy demand, decided to develop effective energy conservation manuals for decision makers in existing buildings. The manuals developed are: Building Owner's and Manager's Guide to Energy Conservation; Building Operator's Guide to Energy Conservation; and Architect's and Engineer's Guide to Energy Conservation. The background and scope of the entire project which led to the development of the manuals is discussed in the introduction of this publication. Part II, Market Analysis, provides insight into the character of the designated audiences for the manuals. Part III, Program for Use, is a marketing and promotion plan for the manuals.

48818 (DOE/TIC—10667) **Proposed energy conservation contingency plan: energency heating, cooling and hot water restrictions; authorities - need, rationale, operation.** (Federal Energy Administration, Washington, DC (USA)). Apr 1977. 28p. Dep. NTIS, PC A03/MF A01.

A proposed energy conservation contingency plan is reviewed. The plan is intended for implementation only in the event of a severe energy interruption or in order to fulfill obligations of the US under the International Energy Program. In the event of a severe petroleum shortage, three types of actions are available to alleviate the adverse impact: actions to increase domestic petroleum supplies and use alternative forms of energy; actions to distribute the available supply in an equitable manner; and actions to reduce public and private demand for energy.

48819 (DOE/TIC—10772) **Proposed energy conservation contingency plan: emergency restrictions on outdoor gas lighting. Economic impact analysis environmental impact assessment.** (Federal Energy Administration, Washington, DC (USA)). Apr 1977. 221p. Dep. NTIS, PC A10/MF A01.

The economic impact of restrictions on the use of illuminated advertising and certain gas lighting is described. The proposed plan would reduce demand for electricity and natural gas. Advertising expenditures would shift to other media - radio, newspapers. No significant effect upon aggregate retail sales is anticipated. Microeconomic effects of the measure are negligible and all effects are minor and/or beneficial.

48820 (STU-I—79-1978) **Construction insulation: heat transport in construction units.** Nilsson, P. (Styrelsen foer Teknisk Utveckling, Stockholm (Sweden)). 1978. 97p. (In Swedish). (STU—76-4927; STU—77-6696). Dep. NTIS (US Sales Only), PC A05/MF A01.

Architectural regulations concerning insulation are tabulated. Heat transfer concepts are defined and specifications for walls, windows, basement walls, girders or timbers, and floors are given. (JSR)

48821 Process and equipment for cooling and heating buildings by two-pipeline water networks by refrigeration machines with water cooled condensers and hot water radiators. Amberg, H.U. (to Weiss (K.) Giessen K.G., Reiskirchen (Germany, F.R.). Werk Lindenstruth; Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,704,857/B/. 7 Sep 1978. 6p. (In German).

This patent is concerned with a true joint operation of radiators and refrigerators for air conditioning rooms in buildings, which are connected to a two-pipeline water network. These rooms can be heated simultaneously (but independently of each other) to the highest possible temperature, or can be cooled to the lowest possible temperature. All the condenser heat remains in the room. The rooms have ceiling air conditioning equipment, whose fans give off air heated in a radiator or cooled in an evaporator into the room. Radiators and the water-cooled condenser belonging to the compressor are connected to the go and return pipes of the water network by electromagnetic valves. There are 2 pumps in the line to the condenser, running in opposite directions. After opening the electromagnetic valve, that pump is switched on automatically which sucks from the cold line at the time. Control for this is from a regulator after comparisons of temperatures in the go and return lines by attached thermostats. The same purpose can be achieved with only one pump with mechanical reversal of direction, e.g., by 3-way valves. With this feed to the condenser by the colder line and with a maximum of 30 to 35°C prerunning temperature in the condenser, the usual refrigerators can be used. For economical operation of convectors of radiators, a temperature of at least 45°C is available in winter.

48822 Heating device in a heat pump unit. Wentzel, H. (to Kueppersbusch und Soehne A.G., Gelsenkirchen (Germany, F.R.); Deutsches Patentamt, Muenchen (Germany, F.R.)). German(FRG) Patent 2,659,480/A/. 6 Jul 1978. 9p. (In German).

A heat pump unit of individual heat pumps of equal output which can be driven individually or in parallel, with the aim of being able to provide very different heat outputs from this modular system in a short time economically is described. Such a modular system makes optimum matching to seasonal demand possible by the stepwise operation of individual heat pumps, as these can then work at high load, i.e., at high efficiency. A single heat pump circuit can be be operated due to a fault or for overhaul, without endangering the whole heat supply. The use of a single heat pump size with all ancillary equipment for all purposes makes mass production possible. According to the heat output required, the necessary pumps, evaporators, condensers etc., are installed adjacent or above one another. If air is the heat source, it is sucked in separately for each pump circuit and given off via a separate sound damping device. The hot water heat exchangers for each heat pump, united with their condensers, are operated in parallel into the forward and return lines.

48823 High voltage electrode boilers. Getz, M.A. (CAM Industries, Inc., Indianapolis, IN). pp 23p, Paper 18 of Proceedings - 13th biennial national industrial electric heating conference. New York, NY; Electrification Council (1978).

From 13. biennial national industrial electric heating conference; Cincinnati, OH, USA (6 Feb 1978).

The operation, economics, and environmental advantages of electrode boilers are reviewed. The role of these boilers in conserving fuels and for off-peak power consumption is discussed. Several examples are presented of the application of high-voltage electrode boilers used to satisfy diverse space heating requirements. (LCL)

48824 Proposed amendments to appliance efficiency regulations concerning storage type water heaters. Preliminary staff report. Sacramento, CA; California Energy Commission (1978). 28p. (NP—23815). Energy Resources Conservation and Development Commission, 111 Howe Ave., Sacramento, CA.

In December 1977 the California Energy Commission adopted energy efficiency standards for automatic storage type water heaters which required all such water heaters sold in California after December 1978 to meet these standards. The revisions in these standards as a result of complaints by one water heater manufacturer are discussed. (LCL)

48825 Proposed amended regulations for appliance efficiency standards (including requirements for intermittent ignition devices), and regulations establishing energy conservation standards for new residential and nonresidential buildings. Sacramento, CA; Energy Resources Conservation and Development Commission (1978). 84p. (NP—23817).

There are presently three sets of regulations which apply to the efficiency of appliances. The Appliance Efficiency Standards and Intermittent Ignition Device (IID) Standard apply to the sale of new appliances. IDD regulations also apply to distribution and installation. The Energy Conservation Standards for New Residential Buildings include two sections which refer to the installation in new residential buildings of heating, ventilating, and air conditioning equipment and water heating equipment. These regulations apply to: hotels, motels, apartment houses, lodging houses, dwellings, convents and monasteries (each accommodating more than ten persons). The Energy Conservation Standards for New Nonresidential Buildings include two divisions which refer to the installation in new nonresidential buildings of heating, ventilating, and air conditioning equipment and water heat equipment. These regulations apply to all buildings except: hotels, apartment houses, dwellings, lodging houses, private garages, sheds, agricultural buildings, nurseries, hospitals, sanitariums, nursing homes, children's homes, mental hospitals, mental sanitariums, jails, prisons, and reformatories. The text of these regulations for California are given.

RESIDENTIAL BUILDINGS

REFER ALSO TO CITATION(S) 48786

48826 (CONF-790678—1) **Reducing residential energy growth with more efficient space heating equipment.** O'Neal, D.L.; Hirst, E. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 26p. Dep. NTIS, PC A03/MF A01.

From ASHRAE society meeting; Detroit, MI, USA (24 Jun 1979).

Several energy-saving design changes in residential space heating systems were examined to determine their energy conservation potential and cost effectiveness. Changes in conventional and advanced systems (such as gas heat pumps) were considered. Energy savings as large as 26, 20, and 57% were estimated for design changes in conventional gas, oil, and electric space heating systems, respectively. These changes increased capital cost of the three systems by 27, 16, and 26%. For advanced gas and electric systems, energy savings up to 45 and 67%, respectively, were calculated. The design changes needed to produce these energy savings increased capital costs 80 and 35%. The energy use and cost relationships developed for the space heating systems were used as input to the ORNL residential energy use simulation model to evaluate the effect of space heating improvements on national energy use to the year 2000. Results indicated a large reduction in energy use if improved conventional and advanced systems were made available to consum-

ers and if consumers minimized lifecycle costs when purchasing these systems.

48827 (DOE/CS—0084) **Annual report to the President and the Congress on the Weatherization Assistance Program for calender year 1978.** (Department of Energy, Washington, DC (USA). Office of State and Local Programs). Apr 1979. 28p. Dep. NTIS, PC A03/MF A01.

The Program of Weatherizaton Assistance for Low-Income Persons was established by the Energy Conservation and Production Act, as amended. The program was established in recognition of the fact that low-income dwellings are frequently inadequately insulated; that low-income persons particularly elderly and handicapped low-income persons, can least afford to make the modifications necessary to provide for adequate insulation; and that weatherization of such dwellings would lower utility expenses for low-income persons as well as conserve needed energy. Initial implementation took place in 1977 and the distribution of $27 million in grant awards to the states and 24 Native American tribal organizations. The program became fully operational in 1978 as an additional $64.066 million was distributed to the grantees. Reports for the quarter ending December 31, 1978, reveal that 95,714 homes were weatherized during the year. It is projected that at the conclusion of the currently authorized program (FY 1980), 1.1 million low-income homes will have been weatherized. This projection represents only 9% of the households eligible for assistance. (MCW)

48828 (DOE/TIC—10143) **Design of residential buildings utilizing natural thermal storage. Final report.** Lewis, D.; Michal, C.; Pietz, P. (Total Environmental Action, Inc., Harrisville, NH (USA)). Jun 1979. Contract EY-76-C-02-0016. 238p. Dep. NTIS, PC A11/MF A01.

The thermal storage capacity found in the materials of conventional building construction affect the heating and cooling requirements of buildings and the long-term efficiency of the space conditioning equipment used to meet these demands. The quantity of this natural thermal storage (NTS) can be increased through architectural design to improve overall building thermal performance and decrease the consumption of conventional fuels used for space conditioning. Improvements in performance come about when heating or cooling peak loads are reduced, when previously poorly used natural energy sources are tapped, or when conventional system efficiencies are increased. The capability of NTS materials to absorb, store and release thermal energies can be used advantageously to bring about these improvements. The technical and economic feasibility of these uses of NTS in residental construction in the north central and northeast US is examined. For many NTS applications, the percentage savings in heating and cooling are impressive, but the actual value of the energy saved is found to be insufficient to justify the incremental cost of NTS over reasonable levels of insulation and other energy strategies. NTS in the form of modified Trombe walls, when combined with energy conserving construction methods, is found to be an effective, available and marketable system. A prototypical residence incorporating this NTS system is designed for instrumentation and as a demonstration of NTS principles. Annual space conditioning costs are reduced to one-third of those found in new construction built to current codes, and less than one-fifth the costs found in typical existing homes.

48829 (SIB-R—47-1978) **Fourteen villas with low energy consumptions at Umeaa, Sweden, studied during the period of construction.** Jonson, J.A. (Statens Inst. foer Byggnadsforskning, Stockholm (Sweden)). 1978. 143p. (In Swedish). Dep. NTIS (US Sales Only), PC A07/MF A01.

Fourteen identical houses with low energy consumption were built at Umeaa, Sweden, by seven different companies. The aim was that the house producers develop and build houses of such a type which could be used in their ordinary production. Already tested methods should be applied in order to save energy. The practical experiences from this project are summarized.

48830 (STUDSVIK/EP—78/100) **Critical analysis of different heating methods.** Andersson, L.; Ljung, L.; Nowacki, J.E. (Studsvik Energiteknik AB, Nykoeping (Sweden)). Mar 1978. 202p. (In Swedish). (STU—78-3265). Dep. NTIS (US Sales Only), PC A10/MF A01.

The aim of the work has been o look for more efficient methods for heating houses. Great efforts are made to define terms which make it possible to describe and compare different systems.

48831 (TID—28819) **Phase One/base data for the development of energy performance standards for new buildings. Final report.** (AIA Research Corp., Washington, DC (USA)). 12 Jan 1978. Contract EX-7-A-29-1020. 110p. Dep. NTIS, PC A06/MF A01.

The objective of this research was to establish a consistent reference, or baseline of current practice for the evaluation of alternative energy standards to be used in the design of new buildings. This was done by estimating the energy consumption of recent residential and nonresidential buildings from building design data. The energy performance of buildings is a function of their physical characteristics, intended use, and climatic conditions. In order to calculate the annual energy consumption of recently designed buildings, it was necessary to (1) classify the variation in building type and climate across the country, (2) define data requirements, identify a building sample, and collect data on building designs, and (3) employ consistent methods to calculate the energy performance from the sample buildings' designs. Buildings were divided into two major groups for the purposes of data collection and data analysis, due to differences in design and construction practices and data availability. Nonresidential building types included commercial and multifamily high rise residential construction. Residential building types included single family homes, low-rise multifamily housing and mobile homes.

48832 **Residential insulation: final environmental report.** Maullin, R.L. Sacramento, CA; California Energy Resource Conservation and Development Commission (1978). 327p. (NP—23872).

This Environmental Impact Report presents an analysis of the potential for significant environmental and socioeconomic impacts of two pieces of legislation recently adopted in California. This legislation requires the establihment of performance standards for residential buildings and for thermal insulation sold within the state. The health and safety hazards of energy-saving building standards and of the production, installation and use of fiberglass insulation in homes are examined and identified. It is concluded that the unavoidable adverse impacts of the proposed standards for buildings and for insulation are minor and temporary, that their implementation will save energy and therfore avoid greater adverse impcts which would result from developing new energy sources, and that consumers will receive economic benefits from reduced utility bills. (LCL)

SCHOOL, MUNICIPAL AND OTHER PUBLIC BUILDINGS

48833 (DOE/TIC—10506) **Public schools energy conservation measures: Washington Elementary School, Kennewick, Washington. Report No. 10.** (American Association of School Administrators, Arlington, VA). 24 Jan 1977. 39p. Dep. NTIS, PC A03/MF A01.

A comprehensive energy analysis was made of the Washington Elementary School in Kennewick, Washington in order to identify cost-effective energy conservation opportunities. The energy conservation measures recommended for this 20 year old building included added roof insulation, reduction in glassed areas, replacement of incandescent lighting, and mechanical adjustments and maintenance. The total cost of these measures is estimated to be $80,425 with a 7 1/2 year payback period. (LCL)

48834 (DOE/TIC—10507) **Public schools energy conservation measures. Report Number 6: P.F. Brown Elementary School, Lubbock, Texas.** (American Association of School Administrators, Arlington, VA). 24 Jan 1977. 40p. Dep. NTIS, PC A03/MF A01.

An engineering analysis of ten representative elementary schools across the nation was undertaken to identify cost-effective energy conserving opportunities. Emphasis was placed on the cost effectiveness of capital modifications utilizing available hardware. The project was designed in 5 phases: (1) select the ten elementary school buildings and analyze their energy conserving opportunities, (2) undertake needed architectural or engineering design work, (3) install or construct recommended modifications, (4) monitor and record post-modification energy use, and (5) disseminate the findings. This report on P.F. Brown Elementary School in Lubbock, Texas, represents the culmination of Phase 1 for one the sites chosen. The building description, data collection, energy conservation opportunities, and economic evaluation for the school are discussed.

48835 (DOE/TIC—10508) **Public schools energy conservation measures, Hindman Elementary School, Hindman, Kentucky. Report No. 4.** (American Association of School Administrators, Arlington, VA). 24 Jan 1977. 41p. Dep. NTIS, PC A03/MF A01.

The study identifies and evaluates energy conserving opportunities for the Hindman Elementary School. The evaluation procedure includes a field survey, computer analysis, and cost estimate. A building description, data collection procedures and a description of energy conservation possibilities (boiler, temperature controls, electrical, and building modifications) are presented.

48836 (DOE/TIC—10513) **Conduct EMS cost analysis and preliminary design.** (JRB Associates, Inc., McLean, VA (USA)). 23 May 1977. 117p. Dep. NTIS, PC A06/MF A01.

Cost-effective Energy Management Systems (EMS) for small Federal buildings are evaluated and recommended. The energy usage and costs in these model buildings were estimated using a computer model. The cost of installing commercially available energy management equipment was estimated for each building and HVAC system type. These figures were used to perform economic analyses of the viability of commercial EMS's in small Federal buildings, defined as any building less than 200,000 sq. ft. New digital technology was explored and an estimate of how the cost of energy management in small buildings could be lowered was made.

These lowered costs were then used to re-estimate the range of buildings to which EMS's can be economically applied.

48837 (DOE/TIC—10514) **Public schools energy conservation measures. Report No. 9, Plover Whiting Elementary School, Stevens Point, Wisconsin.** (American Association of School Administrators, Arlington, VA). 24 Jan 1977. 65p. Dep. NTIS, PC A04/MF A01.

The Federal Energy Administration and American Association of School Administrators co-sponsored a project called Saving Schoolhouse Energy aimed at determining the cost effectiveness of retrofitting schools, principally with "off-the-shelf" hardware, to affect energy conservation. The results of a field investigation, computer simulation and evaluation of the energy conservation opportunities for an elementary school in Stevens Point, Wisconsin, are presented. It was estimated that rescheduling lighting and air conditioner usage, resetting indoor air temperatures, and reducing air infiltration at a total cost of less than $4000 would save energy costs of an equal amount in 1 year's time. (LCL)

48838 (DOE/TIC—10515) **Public schools energy conservation measures. Report Number 8. Garfield Elementary School, Sioux Falls, South Dakota.** (American Association of School Administrators, Arlington, VA). 24 Jan 1977. 57p. Dep. NTIS, PC A04/MF A01.

Energy conserving opportunities for the Garfield Elementary School, Sioux Falls, South Dakota, are identified and evaluated. The analysis is a part of the first phase of a five-part program. The report summarizes the results of the field investigations, computer simulations, and evaluations of the opportunities.

48839 **Coats electric boiler installation at DePauw University.** Gaston, R.D. (DePauw Univ., Greencastle, IN). pp 10p, Paper 19 of Proceedings - 13th biennial national industrial electric heating conference. New York, NY; Electrification Council (1978).

From 13. biennial national industrial electric heating conference; Cincinnati, OH, USA (6 Feb 1978).

In 1973 an economic and technical analysis of constructing a new central heating plant of DePauw University resulted in the choice of a high-voltage electrode electric plant. The construction, operation, and performance of these electric boilers are described. This heating system after 3 years of operation has been economically and environmentally advantageous as compared with coal-fired systems, has presented only minor operating problems, and is not dependent upon fuel supplies. (LCL)

COMMERCIAL AND INDUSTRIAL BUILDINGS

REFER ALSO TO CITATION(S) 48831, 48855

48840 (DOE/TIC—10774) **Proposed energy conservation contingency plan: emergency restrictions on advertising lighting. Authorities, need, rationale, and operation.** (Federal Energy Administration, Washington, DC (USA)). Apr 1977. 25p. Dep. NTIS, PC A02/MF A01.

The emergency restrictions on advertising lighting proposed in Energy Conservation Contingency Plan No. 5 of 1977 are presented. A statement is given on the need for rationale and operation of the Contingency Plan.

48841 (DOE/TIC—10801) **Commercial sector energy consumption: analysis and recommendations for data collection. Final report.** (Metrostudy Corp., Washington, DC (USA)). 15 Feb 1977. 92p. Dep. NTIS, PC A05/MF A01.

Alternative methods for collecting or estimating energy consumption data in the commercial sector are analyzed. The SIC System codes provide the best existing system for developing uniform data. Data analysis in the commercial sector is difficult because a large number of establishments rent space and do not pay for energy consumption directly. The problems of allocating consumption by SIC code within office buildings or shopping malls is addressed in Chapter II along with a discussion of the means, costs, and limitations of such a reporting system. A discussion of costs and problems of developing data from a survey of commercial users is provided in Chapters III and IV. Chapter V discusses improving consumption data by fuel type and data collection on functional end use. Status of state programs is reviewed in an appendix.

TRANSPORTATION

RAILWAY

REFER ALSO TO CITATION(S) 48843

48842 (PB—288866) **Railroads and the environment: estimation of fuel consumption in rail transportation. Volume III. Comparison of computer simulations with field measurements. Final report, June 1977—June 1978.** Hopkins, J.; Hazel, M.; McGrath, T. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Sep 1978. 102p. NTIS PC A06/MF A01.

The report documents comparisons between extensive rail freight service measurements (previously presented in Volume II) and simulations of the same operations using a sophisticated train performance calculator computer program. The comparisons cover a variety of lengthy freight movements over a differing terrain, for TOFC, boxcar, and branchline operations. The simulation shows excellent agreement (within 2%) for aggregated data, although some specific runs or run segments show substantial deviations. Uncertainty is typically plus or minus 10% to 15%, a range equivalent to the scatter generally found within sets of measured data. The report also includes a full description of the simulation program and a general analysis of the major factors which bear upon the validity and accuracy of train performance calculations. Proposed modifications to conventional train resistance equations are suggested.

LAND AND ROADWAY

REFER ALSO TO CITATION(S) 48260, 48883

48843 (DOE/TIC—10739) **Tests of transferability and validation of disaggregate behavioral demand models for evaluating the energy conservation potential of alternative transportation policies in nine US cities. Final report.** (Cambridge Systematics, Inc., MA (USA)). Apr 1977. 40p. Dep. NTIS, PC A03/MF A01.

A transportation policy analysis methodology described in Guidelines for Travel Demand Analyses of Program Measures to Promote Carpools, Vanpools, and Public Transportation, November, 1976 (EAPA 4:1921) is demonstrated. The results reported build upon the two levels of analysis capabilities (a fully calibrated and operational computer package based on a set of disaggregate travel demand models that were estimated on a random sample of urban travelers and a manual procedure or sketch planning pivot-point version of the above methodology) and have undertaken to accomplish the following objectives: transferability, testing the manual approach on actual applications, and validating the method. The first objective was investigated by examining and comparing disaggregate models that were estimated in 7 US cities by eight different organizations. The next two objectives were investigated using separate case studies: the Washington, DC, Shirley Highway preferential transit and carpool lanes; the Portland, Oregon, Banfield Highway Expressway preferential transit and carpool lanes; the Los Angeles, Santa Monica Freeway preferential Diamond Lane and ramp metering facilities for transit and carpools; the Minneapolis, express bus on metered freeway project; and the Portland, Oregon, carpool matching and promotion programs for the general public and for employer-based groups. Principal findings are summarized and results consolidated. (MCW)

48844 **Wind-tunnel study of the effect of gap flow and gap seals on the aerodynamic drag of tractor-trailer trucks.** Buckley, F.T. Jr.; Marks, C.H. (Univ. of Maryland, College Park). *J. Fluids Eng.;* **100**: No. 4, 434-438(Dec 1978).

From Winter annual meeting of the fluids engineering division of the ASME; Atlanta GA, USA (27 Nov 1977).

The effect of gap width on the aerodynamic drag of a cab-over-engine tractor-trailer combination has been investigated for full-scale gap widths ranging from 0.61 m (24 in.) to 1.83 m (72 in.) over a yaw angle range of 0 to 20 deg. The average drag on the vehicle was found to increase by 16% as the gap width increased from 0.61 m to 1.83 m. Drag reductions were found when a vertical seal was placed along the vehicle center line between the tractor and the tailer. Generally, the drag reduction increased as the percentage of gap width that was sealed increased, and as the yaw angle increased. The average drag coefficient reduction provided by a full gap seal increased from 0.02 to 0.05 as the gap width increased from 0.61 m to 1.4 m and then decreased slightly for gap widths up to 1.83 m. The effect of vehicle configuration on gap seal effectiveness was evaluated for a gap width of 1.3 m (51 in.) using models of six different tractors and two different trailers. The average drag coefficient reductions that were found ranged from 0.04 to 0.08 with 83% of the data being either 0.04 or 0.05. It is shown that the use of gap seals on the nearly half-million vehicles which comprise the nation's long-haul trucking fleet can result in the conservation of about 1.4 x 10^9 liters (0.37 x 10^9 gal) of motor fuel each year.

48845 **Wind-tunnel study of the effect of turning vanes on the aerodynamic drag of tractor-trailer trucks.** Buckley, F.T. Jr.; Marks, C.H. (Univ. of Maryland, College Park). *J. Fluids Eng.;* **100**: No. 4, 439-442(Dec 1978).

From Winter annual meeting of the fluids engineering division of the ASME; Atlanta GA, USA (27 Nov 1977).

A wind-tunnel study was made of the reduction of the aerodynamic drag of tractor-trailor trucks due to turning vanes used to control flow separation. A variety of vane settings and positions was investigated on the tractor and on the trailer. It was found that substantial drag reductions were obtained by employing vanes on the

lower part of the front vertical edges of the tractor. Vanes mounted elsewhere had a smaller effect on the aerodynamic drag. Vane setting, turning angle and edge radius were found to be highly important.

48846 Study of the base drag of tractor-trailer trucks. Marks, C.H.; Buckley, F.T. Jr.; Walston, W.H. Jr. (Univ. of Maryland, College Park). *J. Fluids Eng.;* 100: No. 4, 443-448(Dec 1978).

From Winter annual meeting of the fluids engineering division of the ASME; Atlanta GA, USA (27 Nov 1977).

Measurements were made of the base pressure distribution and the aerodynamic drag of a variety of 1/8th-scale tractor-trailer truck models in a wind tunnel at yaw angles ranging from 0° to 20°. Base-drag coefficients and overall aerodynamic-drag coefficients were calculated from this data. The measurements show that the base-drag coefficient of typical tractor-trailer trucks does not vary much with vehicle configuration, and that base drag constitutes approximately 13 to 15% of the total aerodynamic drag at zero yaw. The base drag increases in magnitude and also becomes a larger part of the overall aerodynamic drag as yaw angle increases, reaching about 18 to 25% of the overall drag at 20° yaw. Streamlining the forebody of the vehicle has little effect on the base-drag coefficient, but increases the fraction of the overall aerodynamic drag due to the base.

INDUSTRY AND AGRICULTURE

48847 (DOE/TIC—10537) **Development and establishment of energy efficiency improvement targets for primary metal industries: SIC 33. Final target documentation.** Lownie, H.W. Jr.; Maykuth, D.J.; McLeer, T.J.; Kura, J.G.; Varga, J. Jr.; Griffith, W.I. (Battelle Columbus Labs., OH (USA)). 18 Feb 1977. 31p. Dep. NTIS, PC A03/MF A01.

The final report is presented on a study of energy efficiency goals for the metals industry (SIC 33) to achieve significant energy conservation in this industry by 1980. The methodology used is reviewed. The results showed that the apparent consumption of energy by SIC 33 in 1972 was about 4,246 x 10^{12} Btu. If the industry operated in the target year (1980) at the same energy efficiency (units of output per Btu) as in 1972, because of anticipated growth in units of output the energy consumption in the target year would be about 5,167 x 10^{12} Btu. Based on the data and information available, and based solely on technological feasibility and economic practicability (without the influence of special circumstances), it is judged that SIC 33 could lower its consumption of energy in the target year to 4,456 x 10^{12} Btu. This represents a conservation of 13.8% in energy use per unit of output from 1972 to the targt year. Special circumstances are defined as those beyond the control of establishments within SIC 33. The most significant is the need to comply with environmental-control regulations. Another is the declining grade of certain ores. After consideration of special circumstances over which the industry has no control, it is judged that SIC 33 could lower its consumption of energy in the target year to 4,674 x 10^{12} Btu. This represents a net conservation of 9.5% (10% when expressed to the nearest integer) in energy use per unit of output from 1972 to the target year. (LCL)

48848 (STU—78-3393) **Utilization of energy at ironworks, steelworks and metal works: a summary of a field investigation at works in the Northern countries.** Fors, J.; Hardell, R.; Nord, B. (Styrelsen foer Teknisk Utveckling, Stockholm (Sweden)). Nov 1978. 99p. (In Swedish). Dep. NTIS (US Sales Only), PC A05/MF A01.

Ironworks, steelworks and metalworks in the Northern countries were investigated. Five questions were discussed: the energy supply at the works; conventional techniques for energy management; the need for prototype and demonstration plants; suggestions for future research and development projects; and energy losses in flue gases from rolling-mill furnaces.

ENERGY SOURCES

REFER ALSO TO CITATION(S) 48753, 48856, 48857

48849 (ORAU/IEA—79-9(R)) **Characterization of industrial process energy services.** Boercker, S.W. (Institute for Energy Analysis, Oak Ridge, TN (USA)). May 1979. Contract EY-76-C-05-0033. 59p. Dep. NTIS, PC A04/MF A01.

A detailed analysis of the use of energy by industry is reported. The industrial sector, defined for this study as Standard Industrial Classification (SIC) categories 20 through 39, consumes energy primarily for space conditioning, lighting, electronics, process heat, electro processes, and mechanical drive. The first three of these account for about 1% of total industrial energy used; the last three are the subject of this paper. Almost 70% of the energy consumed by industry in the present decade is used as thermal energy or process heat; thus, process heat received primary attention and has been characterized by temperatures and by transfer media. Because all the data concerning energy which were combined in this study are not for the same year, all process heat data are normalized to 1974 fuels consumed for process heat. These data are later used to characterize all industrial energy use for 1972, a characterization accomplished by assuming that the temperature spectrum in 1972 was the same as in 1974 and by evaluating the uses of electricity by industry. A preliminary investigation of the alteration in energy needs when coal replaces petroleum and natural gas as the feedstock for chemicals industries is also included.

48850 Energy requirements of inputs to agriculture in New Zealand. Dawson, S.M. Auckland, New Zealand; New Zealand Energy Research and Development Committee (1978). 19p. (NZERDC—41).

This paper reports a comprehensive list of estimated energy requirements for materials and equipment used in agriculture in New Zealand. The study is divided into three parts: evaluation and comparison of overseas estimates of the energy requirements of agricultural materials and equipment; calculation of the additional energy required to transport items to New Zealand; and calculation of the energy requirements for items partly or fully manufactured or assembled in New Zealand.

48851 Gas to electric, gas to oil, gas to zero. Zmolek, L.R. (Maytag, Co., Newton, IA). pp 20p, Paper 2 of Proceedings - 13th biennial national industrial electric heating conference. New York, NY; Electrification Council (1978).

From 13. biennial national industrial electric heating conference; Cincinnati, OH, USA (6 Feb 1978).

Experience at the Maytag Co.'s appliance production plant in converting from natural gas to electricity for process heating is described. (LCL)

48852 Energy source selection: a continuing challenge. Bell, E.S. Jr. (Jones Metal Products Co., West Lafayette, OH). pp 8p, Paper 4 of Proceedings - 13th biennial national industrial electric heating conference. New York, NY; Electrification Council (1978).

From 13. biennial national industrial electric heating conference; Cincinnati, OH, USA (6 Feb 1978).

Experience at the Jones Metal Products Co., which manufactures light fixtures, in converting its porcelain enamel furnace from natural gas fuel to electricity is described. (LCL)

MATERIALS

48853 Heat transfer and energy conservation: industry can make it. Kryter, R.J. pp 10p, Paper 1 of Proceedings - 13th biennial national industrial electric heating conference. New York, NY; Electrification Council (1978).

From 13. biennial national industrial electric heating conference; Cincinnati, OH, USA (6 Feb 1978).

The principles of conductive, radiant, and convective heat transfer are briefly reviewed, and the appeal is made to engineers to affect energy conservation by using energy more efficiently. (LCL)

EQUIPMENT AND PROCESSES

REFER ALSO TO CITATION(S) 48851, 48852

48854 (CONS—5058-T1) **Demonstration of a nitrogen based carburizing atmosphere (energy consumption of the endothermic generator). First quarterly report, 1 October 1978—30 December 1978.** Peartree, R.J. (Air Products and Chemicals, Inc., Allentown, PA (USA)). Jan 1979. Contract EM-78-C-01-5058. 22p. Dep. NTIS, PC A02/MF A01.

This first quarterly report details the energy consumption of an endothermic generator. Two different sized generators were studied and found to have basically the same energy usage characteristics. The energy consumption was found to be dependent on generator output, with less energy consumption per unit volume at higher outputs.

48855 (DOE/TIC—10488) **Energy cost reduction for commercial printers.** (Federal Energy Administration, Washington, DC (USA)). 15 Jul 1977. 57p. Dep. NTIS, PC A04/MF A01.

This handbook was developed to help commercial printers cut the cost of energy in their business establishments. It shows how to recognize and act on energy waste in: interior and security lighting; space heating; air conditioning; process; and general plant maintenance. The distribution of energy use varies widely among printing facilities, but certain conclusions can be drawn. Process energy, generally electricity, typically consumes 30 to 50% of total energy costs in the operation of presses and trimmers, compressed air generation, and production of binders. Lighting is a significant expense, and may consume up to 33% of energy expenses. Heating and air conditioning are seasonal and show the expected climatic variations - from 15 to 38%. Hot water generally represents 1 to 2%

of total costs and is usually represented in heating costs. Detailed energy audits were performed at printing plants in various US locations. Recommendations, based on these audits, are made for implementing low-cost energy conservation measures in printing plants. (LCL)

48856 (NMEI—29) **Energy requiremets for agricultural production in New Mexico. Final report.** Patrick, N.A.; Taylor, M.J.; Worman, F.D.; Sweetser, J.S. (New Mexico Univ., Albuquerque (USA). New Mexico Energy Inst.). May 1979. 48p. New Mexico State Univ., Las Cruces.

The energy requirements for on-farm and ranch production of 15 major agricultural commodidites of New Mexico were determined using data collected from producers. Energy consumption was calculated using per acre or animal unit, per pound of production, and per dollar value of production in 1975 as the reporting unit. Energy utilization was divided into three categories: direct, ancillary, and embodied. Primary data concerning production practices, input utilization, machinery and equipment usage, and energy consumption was obtained from a sample of 210 farmers and ranchers from all geographic areas of New Mexico. The data permitted a study of 15 agricultural products representing 96% of the cash receipts from agricultural marketings in the state during 1975. The 15 products studied were cattle, cotton, milk, grain sorghum, alfalfa, sheep, wheat, lettuce, swine, onions, chile, peanuts, corn, potatoes, and apples.

48857 **Proceedings - 13th biennial national industrial electric heating conference.** New York, NY; Electrification Council (1978). 142p. (CONF-780266—). Electrification Council, 90 Park Ave., New York, NY 10016.

From 13. biennial national industrial electric heating conference; Cincinnati, OH, USA (6 Feb 1978).

Eighteen of the 22 papers presented at the meeting are included in this compilation. A separate abstract was prepared for each of 9 papers. The remaining 9 papers were not in scope for the data base. (LCL)

48858 **Saving dollars & energy with microwave heating.** Melgaard, H. (Despatch Industries, Inc., Minneapolis, MN). pp 20p, Paper 8 of Proceedings - 13th biennial national industrial electric heating conference. New York, NY; Electrification Council (1978).

From 13. biennial national industrial electric heating conference; Cincinnati, OH, USA (6 Feb 1978).

The advantages of using microwave heating in industrial processes, e.g., processing rubber for foundry cores, drying plastic molds or bulk material, are discussed. It is claimed that due to energy savings, space savings and inventory savings, etc. production costs can be cut to one-third. The equipment required and limitations in applying microwave power are described. (LCL)

48859 **We didn't need gas after all.** Schultz, G.E. (Reliable Castings Corp., Cincinnati, OH). pp 15p, Paper 16 of Proceedings - 13th biennial national industrial electric heating conference. New York, NY; Electrification Council (1978).

From 13. biennial national industrial electric heating conference; Cincinnati, OH, USA (6 Feb 1978).

Experiences in an aluminum casting plant with electric reverberatory melting furnaces are discussed in terms of operating requirements, performance, and costs. Electric melting resulted in approximately the same cost per pound of aluminum poured, as compared with natural gas-fired furnaces, proved to be an efficient method with an available energy source, and is the preferred heating method in this aluminum plant. (LCL)

48860 **Electrical power demand control in industrial heating.** Becker, O.N. pp 15p, Paper 17 of Proceedings - 13th biennial national industrial electric heating conference. New York, NY; Electrification Council (1978).

From 13. biennial national industrial electric heating conference; Cincinnati, OH, USA (6 Feb 1978).

There are many possible applications of electrical load limiting/demand control in industrial heating. The process itself is used as a swing load to improve the total plant profile and save money. Several such applications, along with equipment and techniques, are described.

48861 **Temperature control using electric power.** Gruber, R.I. (Honeywell Inc., Fort Washington, PA). pp 18p, Paper 20 of Proceedings - 13th biennial national industrial electric heating conference. New York, NY; Electrification Council (1978).

From 13. biennial national industrial electric heating conference; Cincinnati, OH, USA (6 Feb 1978).

Electric industrial heating for use in heat treatments and other industrial processes is becoming increasingly attractive due to electrical energy availability and to environmental and safety considerations. The various types of controls that may be used to control the temperatures of electrically heated processes are described and compared in terms of operating and performance characterists and overall cost. (LCL)

WASTE HEAT RECOVERY AND UTILIZATION

REFER ALSO TO CITATION(S) 48053, 48532, 48753

48862 (CONF-790493—1) **Analysis of industry/utility shared cogeneration benefits.** Barnes, R.W. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 9p. Dep. NTIS, PC A02/MF A01.

From Electric Power Research Institute cogeneration workshop; San Antonio, TX, USA (1 Apr 1979).

The attractiveness of cogeneration to a potential industrial user is influenced by several factors such as steam and electricity load dynamics, criticality of certain loads, size of energy load, personnel requirements, and reliability. Similarly, these same factors plus others, such as the effect on base load demand or scheduling power availability/demand are of concern to a utility in considering cogeneration alternatives. This paper examines various ways in which industrial plants and utilities have interacted to develop mutually beneficial cogeneration systems.

48863 (COO—2893-7) **Energy conservation through industrial cogeneration. Final report.** Joyce, J. (Illinois Univ., Urbana (USA)). Aug 1978. Contract EY-76-S-02-2893. 27p. Dep. NTIS, PC A03/MF A01.

Industrial cogeneration is a method by which manufacturers can generate electricity on site, using the energy which cannot be converted into electricity for heating. A summary of the findings of previous studies on cogeneration is given. Several questions remain unanswered by these studies. One factor that has been neglected until now is the amount of energy required to produce cogeneration equipment. Calculations, therefore, are presented on the estimated energy payback time for vaerious-sized cogeneration plants. This payback time can be used to compare the efficacy of investments in cogeneration equipment with other conservation investments. Estimates of the rates of return available on investments in cogeneration equipment are calculated and displayed. The effect of a 20% investment tax credit for cogeneration equipment and its possible drawbacks are discussed. (MCW)

48864 (ORO—5523-T1) **Utilization of waste heat from Federal facilities. Final report.** (Little (Arthur D.), Inc., Cambridge, MA (USA)). Feb 1979. Contract EC-77-C-05-5523. 190p. Dep. NTIS, PC A09/MF A01.

Separate studies were made for evaluating the technical and economic feasibility of using waste heat from each of four Federal facilities, the Oak Ridge Gaseous Diffusion Plant (ORGDP), Paducah Plant, Portsmouth Gaseous Diffusion Plant (PGDP), and the Savannah River Plant (SRP) for industrial process heat, space heating, power generation, or in agriculture or aquaculture. Environmental and institutional issues associated with waste heat utilization are examined. Recommended uses and the cost of implementing waste heat utilization near each site are discussed. The recommended uses at Oak Ridge include district heating, greenhouse heating, and heat pump-enhanced temperature elevation of the ORGDP waste heat for subsequent process heat use in a textile mill. At Paducah the recommendation is to use heat pumps to raise the waste heat temperature for preheating feedwater for a 1000 MW coal-fired power plant. At Portsmouth greenhouse heating is recommended. At the SRP aquacultural and greenhouse uses and utilization for power generation by means of a Rankine cycle process are recommended. (LCL)

48865 (STU—76-4229) **Recycling of dust from steel furnaces.** Lindskog, L. (Styrelsen foer Teknisk Utveckling, Stockholm (Sweden)). Mar 1978. 56p. (In Swedish). Dep. NTIS (US Sales Only), PC A04/MF A01.

The dust from steel furnaces can be used for the production of gas. The possibilities of using the heat of this gas as process heat, for district heating, or for electricity production are considered.

48866 **Secondary energy resources for the production of malt.** Popv, V.I.; Starechas, P.A. *Fermentn. Spirt. Prom-st.;* No. 6, 21-25(1978). (In Russian).

An examination is made of the basic sources of waste heat which might be used for reducing fuel expenditure, such as the heat from grain germination, furnace gases from the malt dryer, and moist air from the dryer. Both Soviet and foreign recommendations are cited for using waste heat and for more efficient malt drying operations. 5 figures, 5 references

MUNICIPALITIES AND COMMUNITY SYSTEMS

REFER ALSO TO CITATION(S) 48505, 48864

48867 (ANL/ICES-TM—26) **Heat pump centered integrated community energy systems. System development, Franklin Research Center interim report.** Crane, R.E.; Lorsch, H.G.; Werden, R.G. (Argonne National Lab., IL (USA)). Feb 1979. Contract W-31-109-ENG-38. 197p. Dep. NTIS, PC A09/MF A01.

The concept of a heat pump centered integrated community energy system (HP-ICES) was explored based on a reference community located in the Northeast with a population of 10,000. Engineering and economic analyses were performed for the HP-ICES and for conventional heating/cooling systems. Sensitivity analyses were used to determine variations in results from changes in: community size; community energy density; waste heat utilization; energy cost escalation; maintenance and operating personnel; and central HP-ICES ownership. The effect of each of the critical parameters on the economic viability of HP-ICES is shown. Conditions of equal 20-year life cycle costs for HP-ICES and for conventional systems are given. If little or no waste heat is available from nearby industrial installations, high community energy density rates (corresponding to urban conditions) are required for economic viability of HP-ICES. If large amounts of waste heat are available, even relatively loosely built-up communities look promising provided the system is owned by the municipality. If the system is owned and operated by a shareholder-owned public utility, either the community energy density must be high, or large quantities of waste heat must be available, or electricity and oil costs must escalate rapidly during the life of the system to assure economic competitiveness with conventional systems. All HP-ICES use significantly less resource energy than conventional systems. For the baseline system analyzed, HP-ICES use 26% to 40% less resource energy than conventional systems during the heating season and 19% less energy during the peak cooling period. The annual resource energy saving for the HP-ICES is 22% to 34%. It is estimated that the HP-ICES concept is applicable to an average of 500 new communities to be constructed during the 1985—2000 period. The probable resource energy saving during that time period is 1.25×10^{15} Btu.

48868 (ANL/ICES-TM—30) **Heat pump centered integrated community energy systems. Systems development. University of Alabama interim report.** Schaetzle, W.J.; Brett, C.E. (Alabama Univ., University (USA)). Mar 1979. Contract W-31-109-ENG-38. 177p. Dep. NTIS, PC A09/MF A01.

The design, operation, economics, environmental impacts, and expected performance of heat pump centered integrated community energy systems are discussed in detail. (LCL)

48869 (SIB-R—56-1978) **Costs for heating and the limits for profitability using different oil qualities in existing central heating plants.** Kasza, A. (Statens Inst. foer Byggnadsforskning, Stockholm (Sweden)). 1978. 21p. (In Swedish). Dep. NTIS (US Sales Only), PC A02/MF A01.

The total annual cost for heating was studied at many existing central heating plants. This cost varies significantly when different oil qualities are used. The technical-economic consequences of the use of different qualities were investigated.

48870 (STUDSVIK/E—1-78/15) **Examination of cross linked polyethylene for heating systems.** Roseen, R.; Bergman, J. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 4 Jan 1979. 21p. Dep. NTIS (US Sales Only), PC A02/MF A01.

Hot water pipes made of peroxide and silane crosslinked polyethylene have been tested comprehensively since 1974. The test program includes long term hydrostatic tests of straight pipes at elevated temperatures n water, air, and detergents. The influence of pipe bends, degree of crosslinking, and antioxidant systems has been studied separately. The resuls predict a working life of 50 years below 60°C, more than 10 years at 80°C and about 4 years at 95°C. The tested materials were manufactured in 1974 but since then new and improved materials have been produced, and these are currently being tested. Results from this new material are more promising and higher working temperatures are expected to be possible in the future.

48871 (STUDSVIK/ET—78-79) **Pilot study of the heat losses from underground pipes under non-uniform conditions.** Johansson, L. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 31 Jul 1978. 90p. (In Swedish). Dep. NTIS (US Sales Only), PC A05/MF A01.

The aim of the work was to determine the heat losses from underground pipes under non-uniform conditions. The measured values have been compared with those calculated with different mathematical models. In these calculations the ground was assumed to consist of several layers with different thermo-technical properties. The present work is a pilot study. Some viewpoints are given concerning future work in the same field.

PUBLIC SERVICES

REFER ALSO TO CITATION(S) 48815, 48819

PUBLIC UTILITIES

REFER ALSO TO CITATION(S) 48862

48872 (ANL/CNSV—2) **Integrated Community Energy Systems: engineering analysis and design bibliography.** Calm, J.M.; Sapienza, G.R. (Argonne National Lab., IL (USA)). May 1179. Contract W-31-109-ENG-38. 427p. Dep. NTIS, PC A19/MF A01.

This bibliography cites 368 documents that may be helpful in the planning, analysis, and design of Integrated Community Energy Systems. It has been prepared for use primarily by engineers and others involved in the development and implementation of ICES concepts. These documents include products of a number of Government research, development, demonstration, and commercialization programs; selected studies and references from the literature of various technical societies and institutions; and other selected material. The key programs which have produced cited reports are the Department of Energy Community Systems Program (DOE/CSP), the Department of Housing and Urban Development Modular Integrated Utility Systems Program (HUD/MIUS), and the Department of Health, Education, and Welfare Integrated Utility Systems Program (HEW/IUS). The cited documents address experience gained both in the U.S. and in other countries. Several general engineering references and bibliographies pertaining to technologies or analytical methods that may be helpful in the analysis and design of ICES are also included. The body of relevant literature is rapidly growing and future updates are therefore planned. Each citation includes identifying information, a source, descriptive information, and an abstract. The citations are indexed both by subjects and authors, and the subject index is extensively cross-referenced to simplify its use.

MUNICIPAL WASTE MANAGEMENT

REFER ALSO TO CITATION(S) 48258

EDUCATION AND PUBLIC RELATIONS

48873 (HCP/U6241—01) **Status of state energy education policy.** (Education Commission of the States, Denver, CO (USA)). Jun 1979. Contract EU-78-G-01-6241. 51p. Dep. NTIS, PC A04/MF A01.

A survey was conducted in May 1978 to determine the status of state policies and practices regarding energy education among state education agencies, state offices of energy, governors' offices, and state legislatures. Four different questionnaires were constructed and sent to designated officials of those agencies listed above in each state. A total of 208 questionnaires were mailed. Analysis of data received as of July 7, 1978 from 56% of the questionnaires was included in a preliminary report of that date. That data plus additional information received by September 1, 1978 as a result of direct follow-up since July 7 is included in this final report, which represents input from approximately 70% of the agencies surveyed.

48874 **California residential energy consumption survey: knowledge, attitudes, characteristics of the home, and appliance saturation and usage. Final report.** Sacramento, CA; Selection Consulting Center (1978). 99p. (NP—23816).

A sample of 941 residential energy consumers representative of the entire State of California participated in individual one-hour interviews. The residents were found to be well-informed and discriminating consumers and have excellent knowledge of the energy required for performing household functions. They presently see themselves as moderate users of energy and plan to decrease consumption in the future. Attitudes towards energy conservation may be characterized as strongly positive. The most important conservation measures were seen as insulating attics and walls. Strong preferences were found regarding load-management alternatives. Generally, load sharing and time-use pricing were seen as most acceptable, primarily because of their reltively low perceived cost and inconvenience. Of the possible legislatively prescribed mandates considered, requiring new homes and appliances to be energy-efficient were the most acceptable options; banning the use of natural gas for new pools was judged as the least effective. Solar energy systems were thought to be too expensive to purchase and install, as well as unattractive. Only a limited amount of the billing information had been returned when this report was published. (MCW)

ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

REFER ALSO TO CITATION(S) 48751

48875 (UCRL—52553(Vol.2)) **Energy storage systems for automobile propulsion: 1978 study. 2. Detailed report.** Behrin, E.; Anderson, C.J.; Bomelburg, H.; Farahat, M.; Forsberg, H.C.; Hudson, C.L.; Kullman, B.C.; O'Connell, L.G.; Strickland, G.; Walsh, W.J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Dec 1978. Contract W-7405-ENG-48. 295p. Dep. NTIS, PC A13/MF A01.

Volume 2 details the results for FY 1978 of a national, multilaboratory study of energy-storage propulsion systems for automobiles. Presented are the findings and procedures of the five participating panels, including an evaluation of how changing the relationship between specific peak power and specific energy affects electric vehicle performance. Also included are an update of previous results based on new information obtained from ongoing research and development programs, as well as the results of a national energy impact and market penetration analysis of representative future energy storage vehicles. The report contains six sections: (1) Energy Storage Devices; (2) Energy Storage Propulsion; (3) The Evaluation Process; (4) End-Use Analysis Results and Conclusions; (5) National Energy Impact of Energy Storage Automobiles; and (6) Market Demand Forecast for Energy Storage Automobiles.

INTERNAL COMBUSTION ENGINES

SPARK-IGNITION

48876 (PB—288419) **Evaluation of restorative maintenance on 1975 and 1976 light-duty vehicles in Washington, DC. Final report.** Washington, L.H. (General Environments Corp., Springfield, VA (USA)). Mar 1977. Contract EPA-68-03-2185. 248p. NTIS PC A11/MF A01.

A comprehensive study was conducted of automobile exhaust emissions and the effects of restorative maintenance and selective engine parameter maladjustment on these emissions. This was a study of 100, 1975 and 1976 model year consumer owned vehicles from the Washington, D.C. area and was an addition to a total surveillance program which had been conducted in seven major cities (Denver, Washington, D.C., Los Angeles, Houston, Phoenix, Chicago and St. Louis) in order to determine the impact of automobile emissions on air quality. This additional study was not made in all seven of the cities involved in the original study. Specifically, vehicles from the Washington, D.C. area were tested for fuel economy and the content of total hydrocarbons, carbon monoxide, carbon dioxide and nitrogen oxides in their exhaust emissions using the 1975 Federal Test Procedure, the Highway Fuel Economy Test, the Federal Short Cycle, the New York-New Jersey Acid Test, the Clayton Key Mode Test, the Two Speed Idle Test, and the Federal Three Mode Test. (Portions of this document are not fully legible)

EXTERNAL COMBUSTION ENGINES

STIRLING CYCLE

REFER ALSO TO CITATION(S) 48880

48877 (COO—4396-3) **Automotive stirling engine development program. Quarterly technical progress report, April 1978—June 1978.** (Ford Motor Co., Dearborn, MI (USA)). 1978. Contract EC-77-C-02-4396. 101p. (NASA-CR—159436). Dep. NTIS, PC A06/MF A01.

The report covers the third quarter (April—June, 1978) effort of the Ford/DOE Automotive Stirling Engine Development Program, specifically Task I of that effort which is Fuel Economy Assessment. At the end of the previous quarter (March 31, 1978) the total fourth generation fuel economy projection was 23.7 mpg with a confidence level of 40%. At the end of this quarter (June 30, 1978) the total fourth generation fuel economy projection was 26.12 mpg with a confidence level of 44%. This represents an improvement of 66.4% over the baseline M-H fuel economy of 15.7 mpg. The confidence level for the original 20.6 mpg goal has been increased from 53 to 57%. Engine 3X17 has now accumulated a total of 213 h of variable speed running. A summary of the individual sub-tasks of Task I is presented. The sub-tasks are grouped into two categories: Category 1 consists of those sub-tasks which are directly related to fuel economy and Category 2 consists of those sub-tasks which are not directly related to fuel economy but are an integral part of the Task I effort.

ELECTRIC-POWERED SYSTEMS

48878 (DOE/CS—0026/4) **Electric and Hybrid Vehicle Program. Quarterly report, July—September.** (Department of Energy, Washington, DC (USA). Div. of Transportation Energy Conservation). Nov 1978. 19p. Dep. NTIS, PC A02/MF A01.

The progress and activities in DOE's Electric and Hybrid Vehicle Program are reviewed. Topics include: (1) Product Improved Vehicles; (2) Propulsion Systems; (3) EHV Certification Procedures; (4) Focus on Small Business; (5) The Near-Term Battery Program; (6) Program Update; (7) Abstracts; (8) Literature; and (9) Personnel Directory. (TFD)

48879 (STU—77-6207) **Electrical-powered vehicles.** Aakerblom, I. (Svenska Utvecklings AB, Akersberga (Sweden)). Sep 1978. 34p. (In Swedish). Dep. NTIS (US Sales Only), PC A02/MF A01.

An electric-powered car has been constructed mostly utilizing standard components. The car has a series-wound direct current motor with brush shift. Centrifugal slipping coupling has been used in order to obtain a soft start. The weight of working order of the car is 1200 kg and the possible distance driven in urban areas is 50 to 60 km.

HYBRID SYSTEMS

REFER ALSO TO CITATION(S) 48878

48880 (COO—4535-T1) **Stirling engine electric hybrid vehicle propulsion system conceptual design study. Final report.** Dochat, G.; Artiles, A.; Killough, J.; Ray, A.; Chen, H.S. (Mechanical Technology, Inc., Latham, NY (USA)). Aug 1978. Contract EC-77-C-02-4535. 189p. Dep. NTIS, PC A09/MF A01.

Results of a six-month study to characterize a series Stirling engine electric hybrid vehicle propulsion system are presented. The Stirling engine was selected as the heat conversion element to exploit the high efficiency (> .36), low pollution, multi-fuel and quiet operation of this machine. A free-piston Stirling engine driving a linear alternator in a hermatically sealed enclosure was chosen to gain the reliability, long life, and maintenance free characteristics of a sealed unit. The study performs trade off evaluations, selection of engine, battery, motor and inverter size, optimization of components, and develops a conceptual design and characterization of the total propulsion system. The conclusion of the study is that a Stirling engine electric hybrid propulsion system can be used successfully to augment the battery storage of a passenger vehicle and will result in significant savings of petroleum energy over present passenger vehicles. The performance and range augmentation of the hybrid design results in significant improvements over an all electric vehicle. The hybrid will be capable of performing 99% of the passenger vehicle annual trip distribution requirements with extremely low fuel usage. (TFD)

EMISSION CONTROL

REFER ALSO TO CITATION(S) 48876, 49116

ALTERNATIVE FUELS

48881 (CONF-790520—2) **Environmental planning and assessment for highway vehicle use of alcohol fuels.** Bernard, M.J. III; Bevilaqua, O.M. (Argonne National Lab., IL (USA)). 1979. Contract W-31-109-ENG-38. 14p. Dep. NTIS, PC A02/MF A01.

From 3. international alcohol fuels technology; Asilomar, CA, USA (28 May 1979).

Argonne National Laboratory is assisting the Office of Transportation Programs of the U.S. DOE in performing the required environmental planning and assessment for highway vehicle alcohol fuel commercialization in accordance with the National Environmental Policy Act of 1969 (NEPA). In this presentation the process for planning and assessment is given, specific documents resulting from the process are explained. NEPA requires an environmental impact statement (EIS) for every major federal action that may have a significant impact on the quality of the human environment. Three types of environmental documents record this process: the Environmental Development Plan (EDP), the Environmental Assessment (EA) and the Environmental Impact Statement (EIS). The transportation EDP describes the energy conserving technologies; identifies and ranks environmental concerns; outlines strategies to resolve the concerns on a priority basis; and proposes a research program to implement the strategies. This is done annually for the division. In addition, environmental codumentation is scheduled for each technology as it reaches different stages of development. One major document is the EA, prepared when it is not clear whether an EIS is necessary. The information to make such a decision is collected in one detailed assessment of the technology or program. An EIS may then be written if impacts are expected to be significant. An EA is being performed for alcohol (neat and blends) fuels for highway vehicles by ANL.

48882 (CONF-790520—5) **Ethanol/gasoline blends as automotive fuels.** Allsup, J.R.; Eccleston, D.B. (Department of Energy, Washington, DC (USA)). 1979. 13p. Dep. NTIS, PC A02/MF A01.

From 3. international alcohol fuels technology; Asilomar, CA, USA (28 May 1979).

An experimental study of gasoline and 10% ethanol/90% gasoline blends was made using five late-model vehicles operated on a climate-controlled chasis dynamometer. Data were obtained to permit comparisons of fuel economy, emissions, and other significant operational characteristics observed in tests with the two fuels. Volumetric fuel economy was shown to be slightly decreased while energy economy was slightly increased using the ethanol/gasoline blend. Compared with the results using base gasoline, the use of the ethanol/gasoline blend had no adverse effect upon regulated emissions at test temperatures within the range 20° to 75° F; at 100° F there were mirror increases in emissions using the ethanol/gasoline blends. Addition of ethanol at 10% concentration generally either had no effect or only slight effect on unburned hydrocarbon; an exception was noted for 100° F at which temperaure unburned hydrocarbon from the blend was increased significantly over that found with the base fuel. Road octane quality of the ethanol/gasoline blend was increased by about 3.5 numbers over the base fuel.

48883 (DOE/CS—0093) **Project planning document: highway vehicle Alternative Fuels Utilization Program (AFUP).** (Department of Energy, Washington, DC (USA). Office of Conservation and Solar Applications). Jul 1979. 66p. Dep. NTIS, PC A04/MF A01.

This Project Planning Document for the Department of Energy (DOE) Alternative Fuels Utilization Program (AFUP) was developed to provide specific criteria and guidelines for the evaluation and development of nonpetroleum-based highway-vehicle fuels derived from domestic resources. The operative portion of the document is organized in terms of the five basic classes of alternative fuels currently identifiable. Within each class, general areas of R & D that must be addressed are illustrated in terms of a matrix format, while specific project relationships are identified by a corresponding flow chart. It should be emphasized that projects described in this document may well be grouped together and executed within one specific contract. Conversely, broad implications of other projects may well cut across and be integrated into a variety of contracts. Also included in this Project Plan is an overview of the evaluation of and relationships between these several alternative-fuels classes intended to progress toward a uniform and independent domestic highway transportation system. In addition, the mechanism for implementation of the AFUP is outlined.

MATERIALS

REFER ALSO TO CITATION(S) 48749, 49357, 49426

METALS AND ALLOYS

48884 (DOE/ER—0026) **Analysis of hydrogen in solids.** Schowebel, R.L.; Warren, J.L. (eds.). (Sandia Labs., Albuquerque, NM (USA); Department of Energy, Washington, DC (USA). Office of Energy Research). Apr 1979. Contract AC04-76DP00789. 181p. (CONF-790127—). Dep. NTIS, PC A09/MF A01.

From Workshop on analysis of hydrogen in solids; Albuquerque, NM, USA (23 Jan 1979).

Separate abstracts were prepared for the individual papers included.

48885 (DOE/ER—0026, pp 43-52) **Hydrogen depth profiling using secondary ion mass spectrometry.** Magee, C.W. (RCA Labs., Princeton, NJ). Apr 1979.

From Workshop on analysis of hydrogen in solids; Albuquerque, NM, USA (23 Jan 1979).

In secondary ion mass spectrometry (SIMS), samples are bombarded with a beam of primary ions, causing the outermost layers to be sputtered off. The majority of particles leave as neutral particles, but a small fraction leave as positive or negative ions. These ions are focused into a quadrupole mass spectrometer for separation according to their mass/charge ratio. Since the primary ion beam continuously erodes the sample by sputtering, monitoring one or several masses as a function of time yields an in-depth concentration profile. The mass spectrometer is capable of identifying all elements in the periodic table complete with isotopic information, thus enabling SIMS to detect hydrogen and deuterium. However, the application of SIMS to hydrogen measurements has been hampered due to the fact that most depth profiling instruments have been operated in the 10^{-6} to 10^{-7} torr range. At these pressures, deposition of hydrogen-containing molecules onto the surface represents a constant source of hydrogen to the samples during analysis and makes determination of hydrogen in the bulk of the material extremely difficult. This problem has been overcome by performing the SIMS measurements in a vacuum with a hydrogen partial pressure of 10^{-10} torr during analysis. A low-background signal for hydrogen secondary ions is obtained in this work as a result of the good vacuum and a number of instrumental design features of the secondary ion quadrupole mass spectrometer used.

48886 (DOE/ER—0026, pp 64-74) **Use of nuclear reactions and ion channeling techniques for depth profiling hydrogen isotopes in solids.** Appleton, B.R. (Oak Ridge National Lab., TN). Apr 1979.

From Workshop on analysis of hydrogen in solids; Albuquerque, NM, USA (23 Jan 1979).

Hydrogen has always played a preeminent role in materials science because it so readily alters the physical and chemical properties of materials. However, it is often difficult to determine its role because it is one of the most elusive constituents to detect. More recently hydrogen detection has become necessary in numerous energy-related fields. In fusion energy one must understand plasma particle (hydrogen isotope) recycling, trapping and reemission, as well as the effects of hydrogen on the materials properties of first wall structures in plasma devices (i.e., hydrogen embrittlement, sputtering, blistering, etc.). In geology the presence of hydrogen in various forms alters the mechanical properties of many minerals in the earth's crust and enters directly into studies of tectonic processes. Evaluation of hydrogen in moon rocks increases our understanding of solar wind activity. In solar energy, hydrogen plays an important role in amorphous silicon used in fabricating solar cells. Detection of hydrogen is clearly important in the fossil fuel area. Many of the conventional elemental analysis techniques are not directly applicable to hydrogen determination and others can only detect hydrogen when it is in combination with other elements (i.e., H_2O, OH, etc.). In this paper we discuss the use of ion beam techniques for obtaining quantitative depth information on hydrogen in materials and discuss the application of these techniques to several problems important in some of the areas mentioned.

48887 (DOE/ER—0026, pp 104-113) **Neutron scattering as a technique for the study of hydrogen in metals.** Brun, T.O. (Argonne National Lab., IL). Apr 1979.

From Workshop on analysis of hydrogen in solids; Albuquerque, NM, USA (23 Jan 1979).

Neutron scattering techniques are very powerful in studies of the properties of hydrogen atoms either as interstitials in a metal or as constituents of a compound. Detailed information on structural and dynamical properties can be obtained on an atomic scale. The spatial range of a measurement is typically 0.1 A to 100 A, and the dynamical range is 10^{-10} sec to 10^{-14} sec. The neutron scattering cross-sections of the two isotopes of hydrogen, the proton and the deuteron, are very different (see discussion below), so one can obtain complementary information on the structural and dynamical properties of a given hydrogen system by studying both hydrided and deuterated systems. The third isotope of hydrogen, tritium, has neutron cross-sections that differ from both the proton and the deuteron. However, because of the radioactivity of tritium, only very few tritium systems have been studied. Neutron scattering cross-sections are discussed, and a short description of various types of instruments is presented. A few examples of results are also discussed.

48888 (EML—356, pp I.479-I.507) **Analysis of impurities in lead and high-lead alloys using automated multi-element direct current plasma echelle spectrometry.** Griffin, H.; McNulty, R. (Texas Instruments, Inc., Attleboro, MA). 1 Jul 1979.

In Environmental quarterly, March 1—June 1, 1979.

A potential technique is described for the automated simultaneous determination of minor and trace concentrations of Ag, Al, B, Bi, Ca, Cd, Co, Cr, Cu, Fe, Mg Mn, Mo, Nb, Ni, P, Sb, Sn, Ti, V, and Zn in lead and high-lead alloys using direct current plasma echelle optical emission spectrometry. Samples weighing 0.80 g are dissolved in 20 ml portions of 48% HBr, and the resulting solutions are diluted to 50 ml with distilled water. In general, duplicate determinations were found to yield results that differed from each other by $\leq$ 0.006 wt %. This technique has possible forensic and industrial applications.,

PREPARATION AND FABRICATION

REFER ALSO TO CITATION(S) 48916, 48919, 48920, 48922, 48923, 48924, 48961

48889 (BDX—613-2215) **Training for the deburring of precision miniature parts.** Gillespie, L.K.; Bolinger, J.C. (Bendix Corp., Kansas City, MO (USA)). May 1979. Contract EY-76-C-04-0613. 21p. (CONF-790568—1). Dep. NTIS, PC A02/MF A01.

From MINITECH 1, SME; Chicago, IL, USA (22 May 1979).

Formal training in deburring is significant because it is so rare. This lack is particularly evident when one must obtain or train individuals who can finish sophisticated parts to exacting edge requirements. The paper describes the training program developed by one large company. The program is based on the production of sophisticated precision miniature parts requiring high levels of precision and care. The format of the training program and considerations involved are described.

48890 (CONF-790730—1) **Metallographic quality control of welding and brazing.** Slaughter, G.M. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 22p. Dep. NTIS, PC A02/MF A01.

From International Metallographic Society conference; Tamiment, PA, USA (8 Jul 1979).

The value of metallography in assuring integrity in the fabrication of metal and components in energy systems is summarized. Metallography also plays an integral role in quality control of welded and brazed joints. (FS)

48891 (LBL—8628) **Design of duplex low-carbon steels with carbide forming elements.** Costello, P.K. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; California Univ., Berkeley (USA)). Dec 1978. Contract W-7405-ENG-48. 66p. Dep. NTIS, PC A04/MF A01.

The design of duplex ferrite-martensite (DFM) steels with carbide forming elements were investigated. The alloys Fe/0.14 C/1.45 Si/X (X being the substitutional alloying element of Mos or Nb) were selected. The DFM microstructures are controlled by the type of alloy element and the subsequent thermal treatment. The tensile properties of specimens subjected to either the intermediate quench (IQ) or the intermediate air cool (IAC) heat treatments have been correlated with their respective microstructures. Dispersion hardening as a secondary strengthening mechanism is found to limit the ductility and increasing the strength due to carbide precipitation in the ferrite. Unusual behavior in the strength-law of mixtures relationship is observed. The differences in properties displayed by the alloys between the IG and IAC thermal treatments are primarily attributed to the connectivity of the martnesite particles. The IQ treatment provided strength and elongation ductility (i.e., total or uniform elongation to deformation) combinations which are superior to those of the IAC process. Specifically, the niobium steel displayed the best mechanical properties.

48892 (LBL—9103) **Effects of air melting on Fe/0.3/3Cr/0.5Mo/2Mn and Fe/0.3C/3Cr/0.5Mo/2Ni structural alloy steels.** Steinberg, B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1979. Contract W-7405-ENG-48. 53p. Dep. NTIS, PC A04/MF A01.

Thesis.

Changing production methods of a steel from vacuum melting to air melting can cause an increase in secondary particles, such as oxides and nitrides, which may have detrimental effects on the mechanical properties and microstructure of the alloy. In the present study a base alloy of Fe/0.3C/3Cr/0.5Mo with either 2Mn or 2Ni added was produced by air melting and its mechanical properties and microstructure were compared to an identical vacuum melted steel. Significant differences in mechanical behavior, morphology, and volume fraction of undissolved inclusions have been observed as a function of composition following air melting. For the alloy containing manganese, all properties remained very close to vacuum melted values but the 2Ni alloy displayed a marked loss in Charpy impact toughness and plane strain fracture toughness. This loss is attributed to an increase in volume fraction of secondary particles in the nickel alloy, as opposed to both the Mn alloy and vacuum melted alloys, as well as to substaintially increased incidence of linear coalescence of voids. Microstructural features are discussed.

48893 (LBL—9207) **Studies on the electrochemical behavior of potassium in propylene carbonate.** Law, H.H. (California Univ., Berkeley (USA)). May 1979. Contract W-7405-ENG-48. 64p. Dep. NTIS, PC A04/MF A01.

Thesis.

The electrochemical behavior of potassium in propylene carbonate electrolytes was investigated to establish the basic feasibility criteria of an ambient temperature process for the recovery of the metal from its simple salts. The technical grade solvent is purified by passing it through a column of molecular sieves or activated alumina, or mixing it batch-wise with pre-treated charcoal, followed by vacuum distillation with a head temperature of 65°C. The solvent so treated contains less than 1 ppM water, less than 5 ppM propylene oxide, and negligible concentrations of glycols. When the $KACl_4$ solute is prepared by fusion at 500°C, the corrosion rate of potassium in the resulting electrolyte is negligible, in the order of 10^{-6} A/cm^2. The current efficiency of potassium deposition from 0.5 M $KA1C1_4$ solutions is 97.5 +- 2.5%. The deposit contains less than 0.1% aluminum, probably in the form of occluded electrolyte. The apparent exchange current density, as determined by galvanostatic measurements, is in the range of 1-5 x 10^{-5} A/cm^2. The morphology strongly depends on temperature: the metal deposits in loose powdery form at 30°C, fine needles at 50°C, and liquid globules at 70°C, above the melting point of potassium. At 70°C the presence of a cationic fluoro-surfactant at 0.1 - 1.0 gram/liter concentrations leads to the formation of larger, easily collectable metal globules. The stability of potassium with respect to the electrolyte, and the near 100% current efficiency and relatively low cathodic overpotentials associated with the metal deposition process, may provide a basis for the development of a promising alternative to the present thermochemical method for the production of pure potassium metal.

48894 (UCID—18152) **Tantalum fabrication.** Studt, P.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Apr 1979. Contract W-7405-ENG-48. 19p. Dep. NTIS, PC A02/MFA01.

Two components made from LLL stock tantalum sheets have failed to operate as designed under high-explosive loading. The as-fabricated metallurgical state of the tantalum was suspected as one possible cause. To investigate this possibility, the microstructure, hardness, and chemical composition of the component material was evaluated. Both as-received tantalum starting sheets and a formed component were evaluated. The evaluation showed that these components were given an anneal that relieved stresses but did not recrystallize the material. The components were thus stronger than necessary. A recrystallization anneal would further lower both the hardness and the yield stress. Nevertheless, the current metallurgical state of the components should have been adequate to serve the design function.

48895 (UCRL—82371) **Properties of multifilamentary Nb_3Sn superconductors fabricated by the internal bronze approach.** Scanlan, R.M.; Cornish, D.N.; Zbasnik, J.P.; Hoard, R.W.; Wong, J.; Randall, R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1979. Contract W-7504-ENG-48. 14p. (CONF-790815—3). Dep. NTIS, PC A02/MF A01.

From Cryogenic engineering conference; Madison, WI, USA (21 Aug 1979).

Results are described of experiments designed to optimize the critical current and to eliminate some manufacturing problems associated with the internal bronze approach. In addition, conductors of large cross sections (7.6 mm x 7.6 mm) were prepared so that the internal bronze approach could be compared with the external bronze as a method for producing superconductors for mirror fusion applications.

48896 (UCRL—82865) **Surface self-diffusion of germanium and silicon.** Makowiecki, D.M.; Holt, J.B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Jun 1979. Contract W-7405-ENG-48. 6p. (CONF-790682—4). Dep. NTIS, PC A02/MF A01.

From 5. international conference on sintering and related phenomena; Notre Dame, IN, USA (18 Jun 1979).

Surface self-diffusion was investigated by measuring the smoothing of surface profiles on germanium and silicon single crystals. The profiles generally would not change when the crystals were annealed in vacuum. However, removal of oxide films by a reducing atmosphere or flash heating yielded samples that changed their profiles considerably upon annealing. This evidence indicates that surface oxide films are stopping surface diffusion on these crystals. Preliminary data yield values for the surface-diffusion coefficients that are not particularly low when compared with those of metals. However, the data indicate low volume-diffusion coefficients for silicon and germanium, which may contribute to the nonsinterability of these materials.

48897 **High strength and high toughness steel.** Parker, E.R.; Zackay, V.F. (to Dept. of Energy). US Patent 4,140,557. 20 Feb 1979. Filed date 23 Jan 1978. 4p.

PAT-APPL 871,713.

A structural steel is described which possess both high strength and high toughness and has particular application of cryogenic uses. The steel is produced by using the thermally induced phase transformation following heating in a three-phase field in iron-rich alloys of the Fe—Ni—Ti system, with a preferred composition of 12% nickel, 0.5% titanium, the remainder being iron.

48898 **Portable probe to measure sensitization of stainless steel.** Park, J.Y. (to Dept. of Energy). US Patent Application 945,924. 26 Sep 1978. 13p.

A portable electro-chemical cell consists of a reservoir containing an electrolyte, a standard calomel electrode having a terminal disposed in electrical contact with the electrolyte, a graphite electrode that is also in contact with the electrolyte, and a capillary tube that establishes a capillary connection between the standard calomel electrode and the electrolyte near the surface of a sample to be examined. A comparison of the charge transferred in response to a swept electrical potential difference between the graphite electrode and the test sample provides a measure of properties of the sample. The calomel electrode provides a potential for comparison. The cell

is usable in any physical orientation and is portable enough to make useful measurements on installed stainless steels to determine whether a pipe or other structure of stainless steel has been sensitized by welding or other treatment involving heat.

STRUCTURE AND PHASE STUDIES

REFER ALSO TO CITATION(S) 48644, 48891, 48892, 48894, 48909, 48916, 48919

48899 (BNL—26392) **Illustration of ternary diagram synthesis-Mn-Ti-Fe and Al-Ti-Fe.** Kaufman, L.; Dew-Hughes, D. (Manlabs, Inc., Cambridge, MA (USA); Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 27p. (CONF-790910—1). Dep. NTIS, PC A03/MF A01.

From Symposium on calculation of phase diagrams and thermochemistry; Milwaukee, WI, USA (17 Sep 1979).

Alloys based on the CsCl compound phase TiFe have been demonstrated to exhibit unusual hydrogen storae capacity. Improvements of these properties have been pursued by alloying in which the CsCl structure is retained. The conditions under which that can be accomplished can only be predicted if the ternary phase diagram X-Ti-Fe is known. The present paper illustrates iterative computation of the Al-Ti-Fe and Mn-Ti-Fe ternary systems synthesized from the component edge binaries which were previously characterized by the CALPHAD group. The first computations were checked experimentally and it was found that the Mn-Ti-Fe exhibited good predictability while Al-Ti-Fe did not. Thus a second computation of Al-Ti-Fe was carried out. The initial success of the Mn-Ti-Fe computation and failure of the Al-Ti-Fe calculation depended upon prediction of the trajectory of stable propagation of the TiFe-CsCl phase into theTiFe-X ternary system. The importance of developing improved methods for making such predictions is discussed.

48900 (CONF-790653—2) **Equilibrium properties of the fluxoid lattice in single-crystal niobium.** Kerchner, H.R.; Christen, D.K.; Sekula, S.T.; Thorel, P. (Oak Ridge National Lab., TN (USA)). Jun 1979. Contract W-7405-ENG-26. 12p. Dep. NTIS, PC A02/MF A01.

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The dimensions and symmetry of the fluxoid lattice in a single-crystal sphere of niobium have been measured by using a double-perfect-crystal small-angle neutron-scattering technique (DCSANS). The bulk magnetization of the same sample has been measured by a field-sweep technique. In addition, the misalignment between the fluxoids and the applied magnetic field was observed by DCSANS. The experimental methods and most of the results are reported elsewhere. The findings are reported here, and the measurements are compared with realistic microscopic theory where it is available.

48901 (CONF-790653—5) **Soft modes and lattice instabilities in α-U.** Smith, H.G.; Wakabayashi, N.; Crummett, W.P.; Nicklow, R.M.; Lander, G.H.; Fisher, E.S. (Oak Ridge National Lab., TN (USA)). Jun 1979. Contract W-7405-ENG-26. 14p. Dep. NTIS, PC A02/MF A01.

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The many predictions of structure transitions and soft modes in α-U were verified by elastic and inelastic neutron scattering. Such verification was made possible by earlier work that revealed the pronounced anomaly in the Σ_4-LO branch, for the identification of the eigenvector associated with the anomalous mode led to the regions in reciprocal space where one would expect to observe the superlattice reflections. The discovery of the unusual shift in the superlattice reflections toward the origin is somewhat puzzling; perhaps the shift is due to discommensurations in terms of wide stacking solitons. 5 figures, 1 table. (RWR)

48902 (CONF-790839—1) **Misfit dislocations in (111) Pd/(111) Cu bilayers.** Shao, S.S.; Vook, R.W. (Syracuse Univ., NY (USA). Dept. of Chemical Engineering and Materials Science). 1979. Contract EG-77-S-02-4496. 3p. Dep. NTIS, PC A02/MF A01.

From 37. annual Electron Microscopy Society of American meeting; San Antonio, TX, USA (13 Aug 1979).

Misfit dislocations in the early stage of epitaxial growth of Pd on Cu at 25°C were studied. Three different kinds of misfits dislocations were observed and their Burgers vector were determined. (FS)

48903 (LBL—8096) **Direct observation of densification and grain growth in a W—Ni alloy.** Riegger, H.; Pask, J.A.; Exner, H.E. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Apr 1979. Contract W-7405-ENG-48. 33p. (CONF-790682—2). Dep. NTIS, PC A03/MF A01.

From 5. international conference on sintering and related phenomena; Notre Dame, IN, USA (18 Jun 1979).

Densification and grain growth in a tungsten—nickel alloy containing 32 vol % of liquid at 1550°C were studied by conventional methods aided by hot stage scanning electron microscopy and cinematography. This technique yields important additional qualitative information on the mechanisms. Two stages can be discerned. In stage 1, essentially complete pore elimination, rapid grain growth and adjustment of microstructural geometry take place. In the second stage, microstructure coarsening occurs which is characterized by geometric similarity. Columnar grain growth at the surface is observed due to squeezing out of Ni—W liquid, flooding of surface grains and fast evaporation of the Ni. The driving forces for these processes are discussed showing that a high ratio of grain boundary energy to liquid surface energy is essential. A W—Cu alloy with 32 vol % liquid at 1100°C did not show any grain growth due to essentially no solubility of W in Cu at this temperature.

48904 (LBL—9058) **Transmission electron microscopy characterization of dislocated lath martensite.** Narasimha Rao, B.V.; Thomas, G. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Apr 1979. Contract W-7405-ENG-48. 24p. (CONF-790491—1). Dep. NTIS, PC A02/MF A01.

From International conference on martensitic transformations; Boston, MA, USA (24 Jun 1979).

A summary of the recent observations made with high resolution transmission electron microscopy on the morphology, crystallography and formation of lath martensite is presented. The present work has confirmed earlier observations that within each packet the adjacent laths are separated by rotation boundaries, such that a 180° rotation of the reference shear vector is achieved in a group of adjacent laths. The number of laths required to achieve this rotation decreases as the carbon content is increased from 0 to 0.4 wt.%. Concomitant with this, the tendency for adjacent twin related laths increases with carbon content. Retained austenite is found only in carbon containing alloys and even in these alloys it is found only if the adjacent laths are not twin related. High resolution lattice imaging at the retained austenite/lath martensite interface has revealed substantial carbon segregation in austenite during the shear transformation and this raises fundamental questions in regard to whether lath martensites are truly martensitic. Lattice imaging also revealed the presence of interfacial ledges at the retained austenite/lath martensite interface.

48905 **Method for laser-annealing silicon.** Narayan, J.; White, C.W.; Young, R.T. (to Dept. of Energy). US Patent Application 945,925. 26 Sep 1978. 35p.

An improved method for laser-annealing ion-implanted layers in n-type and p-type silicon substrates is provided. This method provides for laser-annealing diffused layers produced by the high-temperature diffusion of dopants into n-type or p-type silicon substrates, laser-annealing n-type or p-type silicon containing grown-in defects, the annealing being effected with at least one laser pulse whose wavelength, energy density and duration comprise a novel and highly effective combination of silicon-melting parameters, and a rapid method for segregating undesired impurities such as copper and iron in a near-surface region of silicon semiconductor material, thus facilitating subsequent removal of the impurities from the material.

MECHANICAL PROPERTIES

REFER ALSO TO CITATION(S) 48549, 48566, 48635, 48636, 48643, 48665, 48705, 48890, 48891, 48892, 48894, 48939, 49284

48906 (AD-A—061176) **Wear resistant coatings for titanium. Final report, 8 June 1977-8 June 1978.** Eckler, T.A.; Manty, B.A. (Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Government Products Div.). Jun 1978. Contract N00019-77-C-0330. 69p. NTIS PC A04/MF A01.

Techniques were developed for pulse-plating a chromium-molybdenum alloy onto titanium alloy substrates. The effect of a direct-current plated chromium-molybdenum coating on the mechanical properties of the titanium alloy substrate was evaluated. The application of a chromium-molybdenum coating to steel was accomplished; wear- and corrosion-resistant properties of this system were ascertained. (Author)

48907 (AD-A—061446) **Influence of temperature on high cycle fatigue properties of Ti-6AL-2Sn-4Zr-6Mo. Final report.** Hodi, F.S. (Army Materials and Mechanics Research Center, Watertown, MA (USA)). Jun 1978. 22p. NTIS PC A02/MF A01.

High cycle fatigue data of unnotched Ti-6Al-2Sn-4Zr-6Mo revealed no change in fatigue strength at 900 F compared to room temperature, 400 F, and 700 F. At 1000 F, the decrease in fatigue strength from that at 900 F and below becomes noticeable. At 1200 F the decrease is significant. The fatigue strength-life curve of specimens coated with electroless nickel and diffusion bonded, which were tested at 1000 F, falls midway between results of uncoated specimens tested at 1000 F and 1200 F. Microstructural

changes occurring with time, at temperature, indicate a refinement of structure. Fractography reveals three distinct areas: an initial radial area which is a mixed mode of quasi-cleavage and intergranular fracture; followed by a radial fibrous zone, the result of dimpled fracture; and finally a shear lip which occurs by shear fracture. (Author)

48908 (COO—3084/64) **Tensile cracks in creeping solids.** Riedel, H.; Rice, J.R. (Brown Univ., Providence, RI (USA)). Feb 1979. Contract EY-76-S-02-3084. 34p. Dep. NTIS, PC A03/MF A01.

The loading parameter determining the stress and strain fields near a crack tip, and thereby the growth of the crack, under creep conditions is discussed. Relevant loading parameters considered are the stress intensity factor K/sub I/, the path-independent integral C*, and the net section stress σ/sub net/. The material behavior is modelled as elastic-nonlinear viscous where the nonlinear term describes power law creep. At the time t = 0 load is applied to the cracked specimen, and in the first instant the stress distribution is elastic. Subsequently, creep deformation relaxes the initial stress concentration at the crack tip, and creep strains develop rapidly near the crack tip. These processes may be analytically described by self-similar solutions for short times t. Small scale yielding may be defined. In creep problems, this means that elastic strains dominate almost everywhere except in a small creep zone which grows around the crack tip. If crack growth ensues while the creep zone is still small compared with the crack length and the specimen size, the stress intensity factor governs crack growth behavior. If the calculated creep zone becomes larger than the specimen size, the stresses become finally time-independent and the elastic strain rates can be neglected. In this case, the stress field is the same as in the fully-plastic limit of power law hardening plasticity. The loading parameter which determines the near tip fields uniquely is then the path-independent integral C*.K/sub I/ and C* characterize opposite limiting cases. The case applied in a given situation is decided by comparing the creep zone size with the specimen size and the crack length. Besides several methods of estimating the creep zone size, a convenient expression for a characteristic time is derived, which characterizes the transition from small scale yielding to extensive creep of the whole specimen.

48909 (COO—4246-7) **Microstructural effects in abrasive wear. Quarterly progress report, 15 September 1978—15 December 1978.** Fiore, N.F.; Kosel, T.H.; Udvardy, S.; Konkel, W. (Notre Dame Univ., IN (USA). Dept. of Metallurgical Engineering and Materials Science). 15 Jan 1979. Contract EF-77-S-02-4246. 38p. Dep. NTIS, PC A03/MF A01.

The purpose of this research project is to establish reliable low-stress and gouging wear rate information for a series of alloy white irons and a series of Co-base PM alloys and to correlate the wear resistance with the microstructural features and mechanical properties of these materials. The characterization of wear rates and microstructures of the alloys was presented previously. SEM characterization of the wear scars were undertaken with the intent of understanding the different responses of the alloys to the different testing conditions. Both RWAT and GAWT wear scars in Ni-Hard 4 were examined. The results of these observations were clarified after SEM/EDXS analysis of the RWAT and GAWT wear scars in the Stellite 6 alloy, in which the carbide positions in the worn surface were found using EDXS x-ray maps. The carbides protrude from the worn surfaces in all RWAT wear scars examined to date, including those of the Ni-Hard 4 alloys abraded with SiO_2 and the Stellite 6 alloy abraded with SiO_2 and Al_2O_3. The harder Al_2O_3 abrasive particles leave long continuous grooves in the surface of the Stellite 6 alloy, and they partially penetrate the Cr_7C_3 carbides. In the GAWT test, some of the alloy carbides are cut off flush with the worn matrix surface, while some undergo gross fracture and are removed in large fragments. Although quantitative ranking of the wear resistance of alloys is not yet possible by SEM analysis, useful qualitative generalizations may be made.

48910 (EPRI-FP—1062(Vol.2)) **Development of a standard methodology for the correlation and extrapolation of elevated temperature creep and rupture data. Volume 2: a state-of-the-art review. Final report.** Goldhoff, R.M. (Metal Properties Council, Inc., New York (USA)). Apr 1979. 382p. Dep. NTIS, PC A17/MF A01.

State-of-the-art for the correlation and extrapolation of elevated temperature creep and rupture data is reviewed. It grew out of a need to study the feasibility of writing a standard practice in the field. The text was supplied to a knowledgeable group of workers in the field and became the focus for the workshop. This volume will be of interest to workers in the field who are not only interested in updating their knowledge but who also will want to attempt to apply the newest techniques available in the area of creep/rupture data fitting and extrapolation.

48911 (EPRI-FP—1062(Vol.2), pp 1.i-1.R.2) **Evaluation of elevated temperature creep and rupture strength data: an historical perspective.** Goldhoff, R.M. (General Electric Co., Schenectady, NY). Apr 1979.

In Development of a standard methodology for the correlation and extrapolation of elevated temperature creep and rupture data. Volume 2: a state-of-the-art review. Final report.

The development of new and more sophisticated analysis techniques for high temperature creep and rupture measurements is described. (FS)

48912 (EPRI-FP—1062(Vol.2), pp 2.i-2.6.34) **Pre-analysis assessment of creep-rupture data.** Conway, J.B. (Mar-Test, Inc., Cincinnati, OH). Apr 1979.

In Development of a standard methodology for the correlation and extrapolation of elevated temperature creep and rupture data. Volume 2: a state-of-the-art review. Final report.

Past experience with pre-analysis assessment of creep-rupture data was impressive and shows it to be a worthwhile supplemental evaluation to a formal parametric analysis. Experience indicates that the continued development of this new concept is justified and should focus on a further study of isotherm extension, slope referral and the transition from region II to region III. It appears valuable to have a portion of this continued development concentrate on a detailed comparison of computer analyses with the behavior pattern deduced by the concept of pre-analysis assessment. There is some indication that certain computer analyses have not been as effective as possible due to the fact that the proper stress dependency could not be accurately identified because too few data points were available. There are some other indications that computer analyses can be ineffective when most of the data are confined to one stress-dependency region and any projection into another stress-dependency region does not accurately sense the actual stress-dependency. When the comparison of computer analyses with behavior patterns deduced from pre-analysis assessment concepts is complete, it should be possible to define a closer and more valuable interaction between the two. Particularly important here is an understanding of how well a computer analysis defines the shape of the isotherms on semi-logarithmic coordinates, regarding the ability of the computer analysis to recognize and identify the transitions from region I to II and II to III. It is felt that pre-analysis assessment can eventually provide some guidelines to the formulation of a test matrix for creep-rupture evaluations that will lead to more effective computer analyses.

48913 (EPRI-FP—1062(Vol.2), pp 3.i-3.a.1) **Comprehensive method of rupture data analysis with simplified models.** Sjodahl, L.H. (General Electric Co., Cincinnati, OH). Apr 1979.

In Development of a standard methodology for the correlation and extrapolation of elevated temperature creep and rupture data. Volume 2: a state-of-the-art review. Final report.

The method of rupture data analysis described uses regression analysis of mathematical models, starting with the standard parametric models and modifying them as needed to improve the fit and the ability to extrapolate reasonably. A new method of handling multiple heat data is included in which the variability between specimens from a single heat and the variability between heats are treated separately. It allows the determination of a single curve for the average properties of a material from data on representative heats of that material. Prediction intervals may be calculated in both the single and multiple heat cases. Analyses of data on two materials are presented to demonstrate the method. One material is a single heat of Astroloy tested by the New England Materials Laboratory. The other material comprises several heats of 304 stainless steel on which data were repoted by the National Research Institute for Metals in Japan.

48914 (EPRI-FP—1062(Vol.2), pp 4.i-4.R.1) **Status of the minimum-commitment method for creep-rupture applications.** Manson, S.S.; Ensign, C.R. Apr 1979.

In Development of a standard methodology for the correlation and extrapolation of elevated temperature creep and rupture data. Volume 2: a state-of-the-art review. Final report.

A status report is presented of the Minimum Commitment Method for generalizing time—temperature parameter analysis of creep-rupture data. Two procedures have been developed, the Focal Point Convergence Method, based on the common intersection of all isothermals at an (imaginary) distant point, and the Oblique Translation Method, based on the assumption that all isothermals can be generated from a single master curve by oblique displacement. Both methods are illustrated for Astroloy, which is subject to a precipitation instability. While the procedure is outlined for individualizing the constants for a particular material, use of universalized constants based on material class has been found advantageous when insufficient information is available for a particularized analyses, or when the relationship among the isothermals does not clearly indicate need for such analysis. Results are presented for several materials analyzed by universalized constants. Application is also extended to treatment of multiheat sets. First the data are analyzed without regard to heat, and then each heat is fingerprinted according to performance relative to mean. Considerable reduction of scatter in heat-to-heat correlation is shown for one set of 304 steainless steel by a modification stress of each heat according to a power law.

48915 (EPRI-FP—1062(Vol.2), pp 5.i-5.A.11) **Regression analysis of creep-rupture data: a practical approach.** Booker, M.K. (Oak Ridge National Lab., TN). Apr 1979.

In Development of a standard methodology for the correlation and extrapolation of elevated temperature creep and rupture data. Volume 2: a state-of-the-art review. Final report.

A generalized linear regression approach to the analysis of creep and creep-rupture data appears to have great promise for future applications. Uncertainties in predictions of creep behavior can be large due to heat treatment, heat-to-heat and other variations in properties. For types 304 and 316 stainless steels and for 2 1/4 Cr—1 Mo steel these uncertainties can be reduced by using regression models that include terms involving the ultimate tensile strength or 100-hr rupture strength of a given heat. A model for Alloy 800H was developed to predict the middle of the scatter band on behavior. Regression analysis of single heat data sets for a variety of materials yielded generally good results. Extrapolation of any model must be done with extreme caution. Possible metallurgical instabilities or changes in creep mechanism can cause serious errors in extrapolated results.

48916 (HEDL-TME—78-98) **Effect of heat treatment on the elevated temperature tensile and fracture toughness response of alloy 718.** Mills, W.J. (Hanford Engineering Development Lab., Richland, WA (USA)). Jun 1979. Contract EY-76-C-14-2170. 60p. Dep. NTIS, PC A04/MF A01.

The effect of heat treatment on the tensile and J/sub Ic/ fracture toughness behavior of Alloy 718 has been characterized at room temperature,, 427°C (800°F) and 538°C (1000°F). Two different heat treatments were used: the conventional (ASTM A637) treatment, and a modified heat treatment designed to improve the toughness of Alloy 718 base metal and weldments. The strength of the conventionally heat treated Alloy 718 was found to be slightly greater than that of the modified Alloy 718. This increased strength observed in the conventional material was attributed to a finer grain size and a finer γ precipitate morphology. The elastic—plastic J/sub Ic/ fracture toughness response of the modified Alloy 718 was found to be superior to the J/sub Ic/ behavior exhibited by the conventional material over the entire test temperature range. Metallographic and fractographic examinations of Alloy 718 fracture surfaces revealed that this increase in fracture resistance was related to the dissolution of Widmanstaetten precipitates during the high temperature solution anneal employed in the modified treatment.

48917 (HEDL-TME—78-101) **Elevated temperature J/sub Ic/ fracture toughness behavior of type 304 stainless steel and type 308 stainless steel weldment. Interim report.** Mills, M.J. (Hanford Engineering Development Lab., Richland, WA (USA)). Jun 1979. Contract EY-76-C-14-2170. 26p. AT.

The elastic—plastic J/sub Ic/ fracture toughness response of FFTF reactor vessel Type 304 stainless steel base metal and Type 308 stainless steel weldment was evaluated at 800°F (427°C) by the multi-specimen R-curve technique. The Type 304 base metal exhibited a high value of J/sub Ic/, 3095 in.-lb/in.^{2} (542 kJ/m^2), indicating that this austenitic stainless steel possesses very high fracture resistance under elevated temperature conditions. The J/sub Ic/ response of the reactor vessel weldment at 800°F (427°C) was slightly less than one-half that exhibited by the base metal. Although the ductile fracture toughness of the weldment was considerably lower than that of the base metal, its fracture resistance was still relatively high compared to those of most structural alloys. Both materials are extremely resistant to unstable fracture even at J levels well above J/sub Ic/. This study indicates that a 1-inch (2.5-cm) thick specimen will meet the proposed ASTM size criterion for establishing a valid J/sub Ic/ value for the Type 308 weldment at 800°F (427°C), but that a 1.5- to 2-inch (3.8- to 5.1-cm) thick specimen of Type 304 base metal would be required to satisfy the proposed size criterion.

48918 (KAPL—4105) **Long-life fatigue test results for two nickel-base structural alloys.** Mowbray, D.F.; Giaquinto, E.V.; Mehringer, F.J. (Knolls Atomic Power Lab., Schenectady, NY (USA)). Nov 1978. Contract EY-76-C-12-0052. 32p. (CONF-790575—1). Dep. NTIS, PC A03/MF A01.

From ASME - materials engineering conference; Washington, DC, USA (8 May 1979).

The results are reported of fatigue tests on two nickel—base alloys, hot-cold-worked and stress-relieved nickel—chrome—iron Alloy 600 and mill-annealed nickel—chrome—moly—iron Alloy 625 in which S-N data were obtained in the life range of 10^6 to 10^{10} cycles. The tests were conducted in air at 600°F, in the reversed membrane loading mode, at a frequency of ~ 1850 Hz. An electromagnetic, closed loop servo-controlled machine was built to perform the tests. A description of the machine is given.

48919 (LBL—9262) **Effect of air-cooling heat treatments on the structure and properties of Fe/4Cr/0.3C/2Mn alloy.** Rabe, T.H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1979. Contract W-7405-ENG-48. 45p. Dep. NTIS, PC A03/MF A01.

Thesis.

The effect of air-cooling heat treatments on the high strength, high toughness Fe/4Cr/0.3C/2Mn alloy has been investigated. Transmission electron microscopy revealed predominately dislocated lath martensite co-existing with lower bainitic ferrite laths when this alloy was air-cooled from a variety of austenitization temperatures. In addition, fine interlath films of retained austenite have been observed. The mechanical properties however, have been found to show a marked degradation in toughness as indicated by plane strain and impact toughness tests, and compared to quench and temper results. This loss of toughness has been attributed to the presence of undissolved carbides and secondary austenitic decomposition products.

48920 (MHSMP—78-38) **Mallet impact test. Process development endeavor No. 216.** West, G.T. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). Sep 1978. Contract EY-76-C-04-0487. 7p. Dep. NTIS, PC A02/MF A01.

Preliminary experiments were conducted using an instrumented hammer on mock billets to determine energy levels input to billets in the machining situation. Observed peak forces and impulses are compared to those observed in two other known initiating mechanisms and are found to be of the same order of magnitude.

48921 (RD-B-N—4219) **Creep in sodium. A review.** Charnock, W.; Cordwell, J.E. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1978. 30p. Dep. NTIS (US Sales Only), PC A03/MF A01.

Available information on the creep of austenitic, ferritic and Alloy-800 type steels in liquid sodium is critically reviewed. Creep properties of stainless steels can be affected by element transfer and corrosion. At reactor structural component temperatures environmental effects are likely to be less important than changes due to thermal ageing. At high clad temperatures (700°C) decarburisation may cause the loss of strength and ductility in unstabilised steels while cavity formation may cause embrittlement in stabilised steels. The properties of Alloy 800 are, in some experiments, found to deteriorate while in others they are enhanced. This may be a consequence of the metallurgical complexity of the material or arise from the nature of the various techniques employed. Low alloy ferritic steels tend to decarburise in sodium at temperatures greater than 500°C and this leads to loss of strength and an increase in ductility. High alloy ferritics are immune to this effect and appear to be able to tolerate a degree of carburisation. Although intergranular cracking may be enhanced in liquid sodium the mechanical consequences are not significant and evidence for the existence of an embrittlement effect not associated with element transfer or corrosion is weak. Stress and strain may enhance element transfer at crack tips. However in real cracks the gettering or supply action of the crack faces conditions the chemistry of the cracks in sodium and protects the crack tip from element transfer. Thus creep crack extension rates should be independent of changes in bulk coolant chemistry.

48922 (WARD-HT—3045-38) **Creep rupture tests of type 304 stainless steel weldments with central axial welds of type 308 stainless steel at 593°C.** Manjoine, M.J. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). May 1979. Contract EY-76-C-02-3045-006. 55p. AT.

The results of creep—rupture tests of axial weldments with uniform gage sections under uniaxial load at 593°C are presented. The analyses of the strain distribution, crack initiation and crack propagation allowed the development of strain criteria for crack initiation. For the range of creep rates and stress states investigated, crack initiation occurred at about 4% strain at 18% of life. The weldment geometry employed was a plate with width to thickness ratio of 10, width to length ratio of uniform section of 1.1, and with lateral restraint at the heads. The average axial strain for an axial weld is the same for all parts of the weld (base metal, heat affected zone, and weld metal) but the local axial strain increases from the heads to mid-length of the test section. Cracking initiated along the heat affected zones when the local strain reached 4% during the creep tests. Multiple evaluations were possible for the damage criteria. Estimates of the local state of stress at crack initiation were made from the local state of strain, and the strain distributions can be compared with the results of analytical approaches.

48923 **Analysis of strengthening mechanisms in alloys by means of thermal-activation theory.** Mulford, R.A. (Argonne National Lab., IL). *Acta Metall.;* **27**: No. 7, 1115-1124(Jul 1979).

Through a systematic measurement of the strain-rate sensitivity as a function of prestrain, theoretical models of thermally activated flow are used to identify and analyze the dominant strengthening mechanisms in a number of commerical and model alloys. Several examples of the usefulness of the technique as a diagnostic tool are given. At temperatures below the plateau stress, measurements are in good agreement with predictions, even for relatively complex commercial materials, and it was demonstrated that changes in strengthening mechanisms (e.g. during age hardening or thermomechanicl

processing) can be followed directly even when the scale of the microstructure is too small for convenient observation by transmission electron microscopy. Experiments at high temperature (above the regime of jerky flow) demonstrate that, except at low stress, the material behavior at moderate strain rates is dominated by strain softening mechanisms such as dislocation rearrangement by cross-slip or climb. The major effect of solution hardening at high temperature is to increase the stress at which these processes occur.

48924 Ductile long range ordered alloys with high critical ordering temperature and wrought articles fabricated therefrom. Liu, C.T.; Inouye, H. (to Dept. of Energy). US Patent 4,144,059. 13 Mar 1979. Filed date 14 Mar 1978. 8p.
PAT-APPL-886,379.

Malleable long range ordered alloys having high critical ordering temperatures exist in the V(Fe, Co)$_3$ and V(Fe, Co, Ni)$_3$ systems. These alloys have the following compositions comprising by weight: 22 to 23% V, 14 to 30% Fe, and the remainder Co or Co and Ni with an electron density no more than 7.85. The maximum combination of high temperature strength, ductility and creep resistance are manifested in the alloy comprising by weight 22 to 23% V, 14 to 20% Fe and the remainder Co and having an atomic composition of V(Fe/sub 0.20-0.26 C/Co/sub 0.74-0.80/)$_3$. The alloy comprising by weight 22 to 23% V, 16 to 17% Fe and 60 to 62% Co has excellent high temperature properties. The alloys are fabricable into wrought articles by casting, deforming, and annealing for sufficient time to provide ordered structure.

PHYSICAL PROPERTIES

REFER ALSO TO CITATION(S) 48903, 48909, 48948, 48988, 49362, 49364

48925 Diffusion and trapping of oxygen in refractory metal alloys. Lauf, R.J. (Oak Ridge National Lab., TN); Altstetter, C.J. *Acta Metall.;* **27**: No. 7, 1157-1163(Jul 1979).

The diffusion coefficient of oxygen has been measured in niobium, vanadium and several dilute substitutional niobium alloys. Measurements were made over the range of 600 to 1150°C (873 to 1423 K) using a solid electrolytic cell technique. Oxygen diffusivity in the alloys was found to be less than in pure niobium. This is interpreted as being due to trapping of oxygen atoms by the substitutional solute atoms. The estimated substitutional-oxygen binding or trap energies (in eV) for the solutes investigated are: Ta, 0.3 +- 0.1; V, 0.55 +- 0.05; Ti, 0.7 +- 0.1; Zr, 0.7 +- 0.05.

48926 Lanthanum nickel aluminum alloy. Gruen, D.M.; Mendelsohn, M.H.; Dwight, A.E. (to Dept. of Energy). US Patent 4,142,300. 6 Mar 1979. Filed date 18 Jul 1977. 4p.
PAT-APPL-816,574.

A ternary intermetallic compound capable of reversible sorption of hydrogen has the chemical formula LaNi/sub 5-x/Al/sub x/, where x is in the range of about 0.01 to 1.5. The method of storing hydrogen using the intermetallic compound is described.

CORROSION AND EROSION

REFER ALSO TO CITATION(S) 48198, 48323, 48324, 48327, 48552, 48561, 48571, 48574, 48576, 48592, 48594, 48658, 48659, 48921, 48967, 49420

48927 (CONF-781001—P2, pp 7.1-7.18) **Study of decarburization constants of pearlitic steels type 2.25Cr—1Mo and carburization of 12KH18N9 and 304 steels.** Starkov, O.V.; Kononov, E.S.; Kononyuk, M.Kh.; Umnyashkin, E.V.; Kozlova, N.A. 1978.
From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

This report presents the results of investigation of the transfer of carbon from austenitic steels to pearlitic steels of Soviet and American manufacture. The tests were performed under isothermal conditions and in a nonisothermal stream of sodium in the 500 to 700°C temperature interval. Equilibrium concentrations of carbon in the steels 10Kh2M and 2.25CR—1Mo and decarburization constants were achieved. A study is made of the influence of carbon on the mechanical properties of pearlitic and austenitic steels, and this influence is evaluated for the specific usage conditions.

48928 (CONF-781001—P2, pp 8.1-8.26) **Comparative material studies of specimens of steels type 2.25Cr—1Mo and 18-8 of Sovient and American manufacture following contact with sodium.** Starkov, O.V.; Golubenkova, S.M.; Kondratenko, S.N.; Kononyuk, M.Kh.; Filin, M.P. 1978.
From 3. US-USSR LMFBR steam generator seminar; Tampa, FL, USA (Oct 1978).

This report presents the results of comparative studies of steels type 2.25Cr—1Mo and 18-8 of Soviet and American manufacture before and after testing in a nonisothermal sodium loop at T = 510°C for test times of up to 4550 hours and in a convection flow of sodium with a high content of oxygen and sodium hydroxide in the 450 to 730°C temperature interval.

48929 (COO—2462-5) **Localized corrosion and stress corrosion cracking behavior of austenitic stainless steel weldments containing retained ferrite. Annual progress report, June 1, 1978—March 31, 1979.** Savage, W.F.; Duquette, D.J. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Materials Engineering). Mar 1979. Contract EY-76-S-02-2462. 9p. Dep. NTIS, PC A02/MF A01.

Localized corrosion and stress corrosion cracking experiments have been performed on single phase 304 stainless steel alloys and autogeneous weldments containing retained delta ferrite as a second phase. The results of the pitting experiments show that the pressure of delta ferrite decreases localized corrosion resistance with pits initiating preferentially at delta ferrite—gamma austenite interphase boundaries. This increased susceptibility is reversible with elevated temperature heat treatments which revert the metastable ferrite phase to the equilibrium austenite phase.

48930 (FE—2327-29) **Evaluation of heat exchanger and turbine materials for use in a coal fired fluidized bed combustion environment. Task II. Monthly technical report, November 1978.** Clark, J.W. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). Dec 1978. Contract EX-76-C-01-2327. 19p. Dep. NTIS, PC A02/MF A01.

Work concentrated on characterization of the attack that occurred on the first set of dual alloy probes removed and replaced after total exposure times of 250 to 367 hours. Rather significant wall thinning was observed on the inbed ferritic steel heat exchanger alloys at a control temperature of 1050°F. These 2.25 Cr and 9 Cr—1 Mo alloys also showed rather high oxidation rates on the air-cooled internal surfaces. Total wall thinning, including the contribution due to oxidation of the i.d., was as high as 0.035 in. in 250 h. The other alloys, tested at higher temperatures, were much less severely corroded. However, there was evidence of pitting attack of the inbed Hastelloy X probe at 1400°F. Although metal loss in 367 h was moderate, some of the microstructural features are similar to those associated with the complete tube wall penetration encountered after 565 h exposure. Further examination of all the alloys is in progress.

48931 High temperature materials problems in fusion reactors. Bressers, J. (Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center); van Witzenburg, W. (Stichting Reactor Centrum Nederland, Petten). pp 237-249 of Petten colloquium on advanced high temperature materials. Kroeckel, H. (ed.). Paris, France; Masson (1977).
From 1. colloquium on advanced high temperature materials; Petten, Netherlands (29 Jan 1976).

Structural materials quoted are the refractory metals vanadium, niobium and molybdenum and their alloys such as Nb-Zr, V-Ti and TZM, nickel base alloys and austenitic stainless steels. Sintered aluminium product, silicon carbide and graphite are also considered. Influence of irradiation on the properties of these materials are examined: atomic displacement in the first wall materials, effects of incidents neutrons (producing changes in alloy composition in the long run), wall erosion, swelling, neutrons-induced activity and effects on physical properties. Corrosion resistance is strongly affected by impurities of the cooling fluids: liquid lithium, lithium containing fluoride salt.

48932 Formation of iron carbonyl between a 1/2 pct Mo steel and high-pressure gases containing carbon monoxide. Inouye, H.; DeVan, J.H. (Oak Rdge National Lab., TN). *J. Mater. Energy Syst.;* **1**: No. 1, 52-60(Jun 1979).

An atomic absorption spectrophotometer was used to measure the formation of iron carbonyl between 1/2 pct Mo steel pipes and flowing high-pressure gases (to 6.9 MPa) containing carbon monoxide. The net formation rate, r, of iron carbonyl was measured as a function of the velocity, temperature, and pressure of the gases to determine the conditions that prevent its formation. These variables and the gas composition affected r as follows: (1) Rate r increases linearly with the gas velocity. Under equilibrium conditions, r is proportional to the gas velocity, but it reaches a limiting value above a critical gas velocity when equilibrium is not maintained. (2) Between 44 and 266°C, r increases with temperature to a sharp maximum at 177°C in a gas mixture containing 17 CO-51 H_2-30 CH_4-2 CO_2 (vol pct). The corresponding maximum in carbon monoxide occurs at 245°C. The data predict that iron carbonyl formation will be negligible above 270°C in the gas mixture or above 285°C in carbon monoxide. (3) Rate r depends on P/sub CO/ in accordance with the equation r = kP/sup n/, where n = 4 to 5 under equilibrium conditions and n = 2 off equilibrium. The analytical procedure used to detect +- 6 vpB (volume parts per billion) of iron carbonyl and +- 1.5 vpB of nickel carbonyl in flowing high pressure gases is described. The reaction rates are described in terms of kinetics and thermodynamic equilibrium.

48933 Corrosion and superficial protection of construction steel parts. Steffens, H.D. (Dortmund Univ. (Germany, F.R.). Lehrstuhl fuer Physikalische Fertigungsverfahren). *Braunkohle;* **31**: No. 1/2, 1-8(Jan-Feb 1979). (In German).

The corrosion of structural steel, appearing in different forms, requires an effective protection of the steel upper surface, both against atmospheric and aqueous corrosion. Quite some measures can lead to its prevention if the influencing parameters are taken into consideration. Cathodic corrosion protection can be realised either by an current or by the expense of an anode, and does appear in various forms as an effective protection for the construction steel parts. The details about the mechanism of the electrochemical reaction of corrosion processes must be known in order to achieve the optimal assortment.

48934 Materials for steam gasification of coal with HTR heat. van Heek, K.H.; Wanzl, W. (Bergbau-Forschung G.m.b.H., Essen (Germany, F.R.)); Gala, A.; Kalwa, G. (Mannesmann-Forschungsinstitut G.m.b.H., Duisburg (Germany, F.R.)). pp 217-223 of Petten colloquium on advanced high temperature materials. Kroeckel, H. (ed.). Paris, France; Masson (1977).

From 1. colloquium on advanced high temperature materials; Petten, Netherlands (29 Jan 1976).

After a survey of the technical realization of steam gasification with nuclear heat, materials testing and development of suited materials are carried out for heat transfer from the core of the nuclear reactor and design of a gas generator. In a fluidized bed of steam gasification equipment, known heat resisting alloys have shown different oxidation mechanisms. Silicon and carbon favour the oxidation of grain boundaries. In alloys with Co, W, Mo, Al and Ti internal oxidation partly combined with oxidation of the grain boundaries takes place. During the testing period of 1,000 hours there is no indication of carburization, sulphidation and attack by hydrogen or ash in all tested alloys. Erosion seems to be negligible. It should be possible to develop alloys with sufficient heat resisting and creep rupture strength.

48935 High temperature protective coatings for gas turbine engines. Current practice and future requirements. Ubank, R.G. (Rolls-Royce Ltd., Bristol (UK)). pp 21-27 of Petten colloquium on advanced high temperature materials. Kroeckel, H. (ed.). Paris, France; Masson (1977).

From 1. colloquium on advanced high temperature materials; Petten, Netherlands (29 Jan 1976).

Gas turbines undergo severe oxidation or hot corrosion, the role of coating is to maintain the integrity of the blades and their guide vanes over extended periods. Coatings failure occurs by erosion, mechanical damage from strains of a thermal origin, interdiffusion with the substrate and surface loss by corrosion. To meet these requirements highly alloyed aluminide coatings or overlay coatings are used. The coating processes are briefly described.

RADIATION EFFECTS

REFER ALSO TO CITATION(S) 48644, 48931, 49419

48936 (BNL—25771) **Recovery by annealing of T/sub c/ in disordered Nb_3Pt.** Dew-Hughes, D.; Jones, R.; Welch, D.O.; Caton, R. (Brookhaven National Lab., Upton, NY (USA); Clarkson Coll. of Tech., Potsdam, NY (USA)). 1979. Contract EY-76-C-02-0016. 7p. (CONF-790653—1). Dep. NTIS, PC A02/MF A01.

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Nb_3Pt has been disordered by rapid splat quenching, which results in the superconducting critical temperature falling from 11K to below 7K. The kinetics of reordering, as evidence by the recovery of T/sub c/, were followed by isothermal and isochronal anneals. The results were analyzed according to Welch's model of reordering in A15 compounds and were found to follow 2nd order kinetics, as had been assumed in an earlier study of recovery in several neutron-irradiated A15 compounds. The activation energy for the reordering process is 3.5 +- 0.2eV. These results will be compared to those on the recovery of samples of Nb_3Pt irradiated to a dose of 7.5 x 10^{18}nvt fast (E > 1MeV) neutrons with a T/sub c/ = 6.15K. The implications of the nature of radiation damage in A15 compounds is discussed.

48937 (CONF-7711121—) **Proceedings of the Indo-German seminar on radiation damage.** (Reactor Research Centre, Kalpakkam (India)). 1977. 521p. Dep. NTIS (US Sales Only), PC A22/MF A01.

From Indo-German seminar on radiation damage; Kalpakkam, India (14 Nov 1977).

Information is presented concerning fundamental aspects of radiation mage; voids, creep, and other mechanical properties; applications to reactor materials; and irradiation studies and facilities. (FS)

48938 (HEDL—6555) **Contribution: DAFS interlaboratory progress report, January—March 1979.** (Hanford Engineering Development Lab., Richland, WA (USA)). 1979. Contract EY-76-C-14-2170. 54p. Dep. NTIS, PC A04/MF A01.

Progress in analyses of irradiation effects on various metallic materials is summarized.

48939 (WARD-CX—94000-1) **Correlation of irradiation creep data obtained in fast and thermal neutron spectra with displacement cross-sections. Topical report.** Foster, J.P.; Boltax, A. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). Jun 1979. Contract AM02-76CH94000. 21p. AT.

Irradiation creep data are available for 20% cold worked M316 stainless steel, 20% cold-worked FV548 stainless steel, solution-annealed 304 stainless steel and aged Nimonic PE16 for the same heats of material and state of stress tested in thermal and fast neutron reactors. The transient and steady state irradiation creep coefficients were calculated using spectrum-averaged displacement cross-section dose units (i.e., displacements per atom). The transient irradiation creep coefficient appears to be subject to considerable scatter. The steady state irradiation creep component was found to be a factor of 2.5 larger in thermal than fast reactors. The 2.5 factor difference results because spectrum-averaged displacement cross-sections, which are the initial trial solution for the effective damage function values, were used to correlate the irradiation creep data. Accommodation of the 2.5 multiplication factor may be accomplished using the iterative procedures reported in the literature for calculating effective damage functions.

48940 Heterogeneous precipitation at internal and external surfaces during irradiation of Ni—12.7 at.% Si. Potter, D.I.; Okamoto, P.R.; Wiedersich, H.; Wallace, J.R.; McCormick, A.W. (Argonne National Lab., IL). *Acta Metall.;* **27**: No. 7, 1175-1183(Jul 1979).

Morphological developments during 400 to 700°C nickel-ion irradiation of Ni-12.7 at.% Si γ/γ' alloys were analyzed by transmission electron microscopy (TEM) and i.r.-emittance measurements. The irradiation caused thin γ' films to form on stacking faults and γ' tori to coat the dislocation loops surrounding these faults. Similar films, containing columnar domains of γ' separated by anti-phase boundaries (APBs), formed at grain boundaries. Films of γ' containing APBs also formed on the irradiated surface. The growth of these surface films changes the i.r. emittance from that of the Ni-12.7 at.% Si solid solution toward that of γ'-Ni_3Si. The initial rate of this change is related to the initial film growth rate and used to determine this growth rate as a function of irradiation temperature. The film growth rate at 10^{-3} displacements per atom per second (dpa s^{-1}) was small below 400°C and above 700°C, but appreciable at intermediate temperatures. The maximum growth rate (~ 30 A min^{-1}) occurred near 550°C. Film growth rate measured at 600°C was directly proportional to dose rate for dose rates from 10^{-4} to 10^{-2}dpa s^{-1}. It is suggested that defect-solute coupling causes the film formation and growth. The temperature dependence of the film growth rate is compared with that of swelling in pure nickel and is discussed in relation to the temperature dependence of defect fluxes arriving at sinks for these defects.

48941 Laser-solid interactions and laser processing, 1978. Ferris, S.D.; Leamy, H.J.; Poate, J.M. (eds.). New York, NY; American Institute of Physics (1979). 699p. (CONF-781121—).

From Annual meeting of Materials Research Society; Boston, MA, USA (28 Nov 1978).

Individual papers were abstracted separately for the data base.

CERAMICS, CERMETS, AND REFRACTORIES

48942 (DOE/ER—0026, pp 75-84) **^{15}N nuclear reaction profiling of hydrogen in solids.** Lanford, W.A. (Yale Univ., New Haven, CT). Apr 1979.

From Workshop on analysis of hydrogen in solids; Albuquerque, NM, USA (23 Jan 1979).

The ^{15}N hydrogen profiling method is described and its use to study a variety of problems at the WNSL at Yale is reviewed briefly. The use of this method in the study of the reaction between water and glass is discussed in some detail.

PREPARATION AND FABRICATION

REFER ALSO TO CITATION(S) 48175, 48176, 48638, 48803, 48950

48943 (CONF-790682—1) **Magnesium oxide enhancement of sintering of alumina.** Morgan, C.S.; Tennery, V.J. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 10p. Dep. NTIS, PC A02/MF A01.

From 5. international conference on sintering and related phenomena; Notre Dame, IN, USA (18 Jun 1979).

It is known that small quantites of MgO enhance sintering of Al_2O_3, the process of enhancement has not been established. Sintering data for compacts of several oxides heated at various rates to a specific temperaure show that the final density achieved in powder compacts is relatively insensitive to heating rates above about 2°C/s. Transmission electron microscopy studies of these compacts show evidence of dislocation generation in the sintering material in regions between adjacent particles. Sintering measurements of compacts of Al_2O_3 and MgO doped Al_2O_3 show that MgO contributes to the initial densification even when high heating rates are applied to the compacts. Comparison of the observed densification kinetics with those of a diffusion process shows that the experimental results are incompatible with a diffusion controlled process. It is proposed that MgO on the surface of Al_2O_3 particles increases the ease of dislocation motion and generation compared to pure Al_2O_3. This enhancement improves the compact densification.

48944 (GEPP-TIS—441) **Improving the voltage holdoff performance of alumina insulators in vacuum through quasimetallizing.** Miller, H.C. (General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.). 6 Aug 1979. Contract EY-76-C-04-0656. 27p. Dep. NTIS, PC A03/MF A01.

Treatment of the surface of an alumina insulator with coatings incorporating varying amounts of Cr, Mn, and Ti can significantly increase the vacuum voltage holdoff capability of the insulator (up to 25%). During processing (quasimetallizing) the coating penetrates into the alumina, so it is insensitive to mechanical damage. This quasimetallizing treatment is also compatible with subsequent metallizing and brazing of the alumina insulator. A 7 Mn:1 Ti mix performed very well, being found to be as effective on a 94% Al_2O_3 alumina as on the previously investigated 95% Al_2O_3, 1% Cr_2O_3 alumina. Mixes of 6 Mn:1 Ti:1 Ca and 6 Mn:3 Cr performed about as well as the 7 Mn:1 Ti mix, but no better. Quasimetallizing with pure Mn improved the voltage holdoff capability of alumina by about half as much as when using the 7 Mn:1 Ti mix. Mixes with relatively high titanium content (4 Mn:3 Ti and 3 Mn:3 Ti:2 Cr) significantly increased the voltage holdoff capability of the alumina, but unfortunately were much more prone than the 7 Mn:1 Ti mix (or plain alumina) to suffer severe and permanent damage when a breakdown did occur. Quasimetallizing with appropriate formulations has been shown to change the surface characteristics of alumina in two ways: it decreases the surface resistivity of the alumina, and it decreases the secondary electron emission yield of the alumina. Each change improves the voltage holdoff characteristics of the alumina.

48945 (UCRL—82515) **Sintering kinetics of pure and doped boron carbide.** Lange, R.G.; Munir, Z.A.; Holt, J.B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Jun 1979. Contract W-7405-ENG-48. 11p. (CONF-790682—3). Dep. NTIS, PC A02/MF A01.

From 5. international conference on sintering and related phenomena; Notre Dame, IN, USA (18 Jun 1979).

The sintering of pure and doped boron carbide was investigated over the temperature range 1898 to 2380°K and at additive levels ranging from 0.75 to 10.0%. The addition of 0.75 and 3.8 wt% of AlF_3, Ni, Fe, and Cu deactivated the sintering of B_4C at all temperatures. In contrast, the addition of 10.0 wt% these additives resulted in enhanced shrinkage in B_4C for the temperatures 1898 and 2133°K. At the highest temperature, 2380°K, the addition of 10.0 wt% AlF_3 was the only case where enhanced shrinkage was observed. In this case, x-ray analysis showed the formation of a $B_{12}C_2Al$ compound and the release of fluorine. These results are interpreted in terms of a grain-boundary diffusion process for pure and doped B_4C.

STRUCTURE AND PHASE STUDIES

REFER ALSO TO CITATION(S) 48692, 48943, 48949

48946 (DOE/ER—0026, pp 7-19) **Structural, dynamical and transport properties of hydrogen in insulating materials.** Bates, J.B. (Oak Ridge National Lab., TN). Apr 1979.

From Workshop on analysis of hydrogen in solids; Albuquerque, NM, USA (23 Jan 1979).

Hydrogen occurs in a wide variety of solid inorganic materials as either a major component, such as H_2O in a crystalline hydrate, or as a trace impurity such as OH^- in Al_2O_3. As an impurity, hydrogen may be inadvertently or intentionally introduced into these materials during crystal growth. Hydrogen can also be introduced into ceramic oxides by diffusion at high temperatures or high pressures and by ion bombardment with protons. Raman scattering and infrared absorption are useful techniques for identifying the type of hydrogenic species, investigating the structure of the hydrogen-associated defect and the nature of the bonding, and for determining the hydrogen concentration in insulating materials. The purpose of this report is to summarize the important principles in the application of Raman scattering and infrared absorption spectroscopy to the study of hydrogen and its isotopes in inorganic solids. These principles will be illustrated mainly with experimental results obtained from investigations of hydrogen in TiO_2 and Al_2O_3.

48947 (IEA—493) **Analysis of neutron parameters in light water moderated lattices of ThO_2 and UO_2 fuel rods.** Onusic Junior, J.; Oosterkamp, W.J. (Instituto de Energia Atomica, Sao Paulo (Brazil). Div. de Engenharia Nuclear). Dec 1977. 21p. (In Portuguese). Dep. NTIS (US Sales Only), PC A03/MF A01.

A large number of light water moderated lattices of UO_2 and ThO_2 fuel rods were analyzed with the code HAMMER. The purpose of the study was to compare experimental results with computer calculated values. The model employed is described and some modification were introduced in the resonance parameters of Th-232 to increase the agreement with the experimental value.

PHYSICAL PROPERTIES

REFER ALSO TO CITATION(S) 48944

48948 **Modeling of interstitial solute behavior in a body-centered cubic metal.** Steckel, G.L.; Altstetter, C.J. (Univ. of Illinois, Urbana). *Acta Metall.;* **27**: No. 7, 1271-1279(Jul 1979).

Theoretical solution models from the literature are applied to the data of a recent thermodynamic study of vanadium—oxygen solid solutions. It is shown that the quasi-chemical and central atoms models can describe the behavior of interstitial oxygen in the high temperature solid solution. The analysis shows that there are oxygen—oxygen repulsive interactions which may extend to the third nearest neighbor shell. The limitations of the models and possible discrepancies between the thermodynamic results, anelasticity studies and elasticity calculations are discussed.

48949 **Study of carbon-substituted EuB_6.** Kasaya, M.; Tarascon, J.M.; Etourneau, J.; Hagenmuller, P. (Universite de Bordeaux I, Cedex, France). *Mater. Res. Bull.;* **13**: No. 8, 751-756(Aug 1978).

Carbon-substituted europium hexaborides EuB/sub 6-x/C/sub x/ have been prepared by borothermal reduction. The homogeneity range is $0 \leqq x \leqq 0.21$. The lattice parameter decreases progressively from 4.1855 A to 4.1703 A with rising x. The paramagnetic Curie temperature diminishes from 15 to - 6.5 K. Electrical properties have been studied for $x = 0$ and $x = 0.05$ on single crystals prepared by an Al-flux technique. Between 30 and 300 K both single crystals have metallic behavior and their resistivity at 300 K is of the order of $10^{-4}\ \Omega$ cm. However each single crystal shows a rather different temperature-dependence of resistivity at low temperature.

48950 **High Na^+-ion conductivity in $Na_5YSi_4O_{12}$.** Hong, H.Y.P.; Kafalas, J.A.; Bayard, M. (Massachusetts Inst. of Tech., Lexington). *Mater. Res. Bull.;* **13**: No. 8, 757-761(Aug 1978).

Ceramic specimens of $Na_5YSi_4O_{12}$ with densities up to 95% of theoretical and Na^+-ion conductivities at 300°C up to 0.15 $\Omega^{-1}\,cm^{-1}$ have been fabricated from powders synthesized by solid-state reaction of $Na_2C_2O_4$, $Y_2(C_2O_4)_3$, and SiO_2. Conductivity values obtained by complex impedance measurements on one specimen between 25 and 320°C gave an activation energy of 0.15 eV above 175°C, but the ln (σ T) versus 1/T plot was not linear at the lower temperatures.

CORROSION AND EROSION

REFER ALSO TO CITATION(S) 48198, 48803

RADIATION EFFECTS

REFER ALSO TO CITATION(S) 48941

POLYMERS AND PLASTICS

PREPARATION AND FABRICATION

48951 (SAND—79-0962C) **Removable polyurethane encapsulants. I. Formulation and long term considerations.** Wischmann, K.B. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 11p. (CONF-790632—7). Dep. NTIS, PC A02/MF A01.

From JOWOG-28; Albuquerque, NM, USA (11 Jun 1979).

A solvent was developed for removable encapsulants and to evaluate their long term properties. These materials were developed to provide a component rework capability so that sophisticated electronic packages can be repaired without discarding the entire and often costly assembly. Encapsulants which are crosslinked such as epoxies and silicones are difficult to remove either by mechanical means or by solvent attack. The newly developed removable encapsulants are linear polyurethanes which can be dissolved in appropriate solvents with minimal damage to components.

STRUCTURE AND PHASE STUDIES

REFER ALSO TO CITATION(S) 48953

MECHANICAL PROPERTIES

48952 (EPRI-EL—1093) **Further development of Polysil material systems for electrical applications. Final report.** Schroeder, J.E. (Lindsey Industries, Inc., Azusa, CA (USA)). May 1979. 91p. Dep. NTIS, PC A05/MF A01.

Polysil is an inexpensive composite dielectric material consisting of a blend of aggregates bound together in an organic matrix. Several types of coatings can be applied to the insulator surfaces to enhance their resistance to moisture. Polysil has the advantage of room temperature processing, which enables metallic inserts to be cast in place. Internal electric grading is possible because the thermal coefficient of expansion can be modified to match that of the embedments. It has also shown excellent weathering capability under high voltage stress. The processing methods and mechanical and dielectric properties of Polysil are described.

48953 (UCRL—82694) **Characterization of halthane polyurethane adhesives. I. Dynamic mechanical and thermal properties.** Hoffman, D.M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jun 1979. Contract W-7405-ENG-48. 25p. (CONF-790668—2). Dep. NTIS, PC A02/MF A01.

From DOE weapons complex annual adhesives conference; Amarillo, TX, USA (5 Jun 1979).

The dynamic mechanical properties of Halthane 73-, and 87-, and 88-series polyurethane adhesives have been examined from -150° to 200°C. These polyurethanes contain polyether—isocyanate soft segments that exhibit a low temperature secondary relaxation at -150°C. The lower molecular weight polyether—isocyanate soft segments of 73-series adhesives have higher glass transition temperatures (-50°C) than the higher molecular weight polyether-isocyanate soft segments of 87- and 88-series adhesives (-70°C). The 73-series polyurethanes also show a weak peak in the loss modulus at about -100°C. The relaxation strength of the soft segment glass transition depends on the moelcular structure of the hard segments. Chemically different hard segments produce adhesives with different shear storage modulus over the temperature range (5×10^8 Pa for 88- and 87-series adhesives and about 1×10^6 Pa for 73-series adhesives). Chemical crosslinks in the hard segments of the 73-18 and 73-19, extend the elastomeric character of these adhesives about 100°C above the viscous flow region of 73-14 and 73-15 adhesives. Differential Scanning Calorimeter (DSC) traces provide similar information on the glass transitions of these polyurethanes. Calorimetric measurements indicate slight amounts of crystallinity in these adhesives. Degradation of these polyurethanes begins between 200°C and 250°C with the 87 and 88 polymers being slightly more thermally stable.Thermal Gravimetric Analysis (TGA) shows that the degradation of every member of the Halthane 73-, 87-, and 88-series polyurethanes is bimodal probably due to different rates of pyrolysis of the hard and soft segments.

PHYSICAL PROPERTIES

REFER ALSO TO CITATION(S) 48952, 48953

DEGRADATION AND EROSION

REFER ALSO TO CITATION(S) 48327

RADIATION EFFECTS

48954 (AERE-R—8923) **Effects of radiation on electrical insulators in fusion reactors.** Phillips, D.C. (UKAEA, Harwell. Atomic Energy Research Establishment). Jun 1978. 54p. Dep. NTIS (US Sales Only), PC A04/MF A01.

The effects of radiation on organic polymers and ceramics are reviewed with particular reference to the possible uses of these materials as electrical insulators in fusion reactors.

PREPARATION AND MANUFACTURE

REFER ALSO TO CITATION(S) 48273, 48275, 48277, 48287

STRUCTURE AND PHASE STUDIES

REFER ALSO TO CITATION(S) 49363

PROPERTIES

REFER ALSO TO CITATION(S) 48275, 48287, 48584

CORROSION, EROSION, AND DEGRADATION

REFER ALSO TO CITATION(S) 48327

RADIATION EFFECTS

REFER ALSO TO CITATION(S) 48941

CHEMISTRY

REFER ALSO TO CITATION(S) 48749

48955 **Energetic evolution of complex networks of reactions.** Glansdorff, P. (Univ., Brussels, Belgium). pp 41-54 of Energetics of coupled biochemical processes and of their chemical models. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

The main characteristic of all the physical, chemical or biological systems in their solid, liquid, or gaseous state proceeds from their basic complexity due to numerous interactions between the constitutive particles. With regard to the evolution of such continuous media, two important properties arising directly from this complexity are to be underlined. The first corresponds to the irreversibility of all natural processes. Indeed, in agreement with classical mechanics one observes that irrreversibility is absent from the dynamic laws governing the trajectories of only a very small number of particles, and thus requires for its appearance a minimum of complexity. The second effect of the same basic complexity is characterized by the fluctuations, which have become especially important in the actual problems related to the stability of non equilibrium processes, as for instance the stability of steady states, far from euilibrium that is for large values of the external constraints prescribed to the system. The influence of these two effects on the evolution of some chemical processs including biological illustrations is investigated.

ANALYTICAL AND SEPARATIONS CHEMISTRY

ACTIVATION AND NUCLEAR REACTION PROCEDURES

REFER ALSO TO CITATION(S) 48097, 48239, 48884, 48886, 48887, 48942

CHEMICAL PROCEDURES

REFER ALSO TO CITATION(S) 48183

48956 (CONF-790663—1) **Multicomponent methods for the identification and quantification of polycyclic aromatic hydrocarbons in the aqueous environment.** Griest, W.H.; Maskarinec, M.P.; Herbes, S.E.; Southworth, G.R. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 22p. Dep. NTIS, PC A02/MF A01.

From Symposium on analysis of waters associated with alternate fuel production; Pittsburgh, PA, USA (4 Jun 1979).

The development of sensitive and specific analytical methodology for the determination of the polycyclic aromatic hydrocarbon (PAH) content of aqueous samples is critical to studies defining the discharge, distribution, persistance, and fate of PAHs in the aqueous environment. Multicomponent PAH analytical methods developed in this laboratory for freshwater streams and rivers and their application to samples from the aqueous environment around a coal coking plant are discussed.

RADIOMETRIC AND RADIOCHEMICAL PROCEDURES

REFER ALSO TO CITATION(S) 48247

48957 (CONF-790602—70) **Nondestructive assay technique for ^{233}U and ^{235}U in mixed samples.** McNeany, S.R.; Allen, E.J. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 7p. Dep. NTIS, PC A02/MF A01.

From ANS annual meeting; Atlanta, GA, USA (3 Jun 1979).

Individual fissile isotopes in small samples of mixed ^{233}U and ^{235}U can be determined using thermal neutron interrogation with delayed and prompt neutron detection. The technique is rapid (< 10 min.), nondestructive, and can obtain precisions of 1%. (DLC)

48958 (IDO—12083) **Program and abstracts of twenty-third annual conference on bioassay, environmental, and analytical chemistry.** (Idaho National Engineering Lab., Idaho Falls (USA)). 1977. 37p. (CONF-770926—(absts)). Dep. NTIS, PC A03/MF A01.

From 23. annual conference on bioassay, environmental and analytical chemistry; Moran, WY, USA (15 Sep 1977).

Abstracts are presented for 29 papers, covering topics related to assay for Pu and other radionuclides, and contamination problems in radiochemical analysis. (DLC)

48959 (MLM—2602(OP)) **Simplified HT—HTO in air measurement system.** Bishop, C.T.; Carter, D.C.; Farmer, B.M.; Rhinehammer, T.B.; Sheehan, W.E. (Mound Lab., Miamisburg, OH (USA)). 1979. Contract EY-76-C-04-0053. 4p. (CONF-790602—67). Dep. NTIS, PC A02/MF A01.

From ANS annual meeting; Atlanta, GA, USA (3 Jun 1979).

A system was developed to measure both elemental tritium and tritium oxide in air at Mound. This system employs a hot Pd oxidation catalyst and ethylene glycol water vapor traps; scintillation solution is added to the latter. (DLC)

SPECTRAL PROCEDURES

REFER ALSO TO CITATION(S) 48885, 48946, 48956, 48972

48960 (ORNL/TM—6808) **Mass spectrometry of plutonium, uranium, and thorium.** Walker, R.L.; Bertram, L.K.; Musick, W.R.; Smith, D.H. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 18p. AT.

Mass spectrometric methods for the determination of plutonium, uranium, and thorium have been developed using the resin bead technique of sample preparation and the two-stage, 30-cm radius mass spectrometer for mass analysis. The methods have been applied to the isotopic characterization and isotope dilution measurement of the amount of plutonium and uranium in high burnup, highly irradiated Robinson-Light Water Reactor (LWR) fuel. Highly enriched (98 to 99% ^{233}U and ^{242}Pu tracers were used for the isotope dilution determinations. Isotopic results from this work indicate that a precision of +- 0.5% is obtained for minor isotopes in the 1% concentration range and +- 0.1% for major isotopes in the 50% to 99% range. Analyses of synthetic dissolver solutions over a period of several months show that the accuracy of the isotope dilution measurement of plutonium and uranium is $< 0.5\%$ with precisions of 0.9% and 0.6% for plutonium and uranium respectively. In addition to plutonium and uranium, a tentative method for thorium has been developed and evaluated on cold synthetic standards and samples using ^{230}Th as tracer for the isotope diultion measurement. The use of ^{236}U as tracer when analyzing samples containing appreciable ^{233}U from thorium—uranium fuels is proposed.

SEPARATION PROCEDURES

REFER ALSO TO CITATION(S) 49209

48961 (BM-RI—8357) **Prototype commercial electrooxidation cell for the recovery of molybdenum and rhenium from molybdenite concentrates.** Scheiner, B.J.; Pool, D.L.; Lindstrom, R.E.; McCleland, G.E. (Bureau of Mines, Reno, NV (USA). Reno Metallurgy Research Center). 1979. 13p. NTIS.

As part of the goal to maximize minerals and metals recovery from primary domestic resources, design factors associated with minimizing current leakage in bipolar cell configurations were studied as a means of improving the efficiency of bipolar electrooxidation cells. Initial studies that were conducted in a small bipolar cell operating at 140 to 145 volts and 15.4 A indicated how design factors could be employed to minimize current leakage around adjacent electrodes during cell operation. Based on these results, a 40-electrode, 108-kVA prototype of an industrial-sized cell was constructed and tested for extracting metal values from offgrade molybdenite concentrates. The feasibility of recovering molybdenum and rhenium from the oxidized pulp also was determined. Feed to the process sequence consisted of flotation concentrates containing 16 to 35% Mo as molybdenite and 6 to 15% Cu. Electrooxidation in the prototype cell results in 84 to 97% Mo and Re extraction with a corresponding energy consumption of 9 to 13 kWh/lb Mo extracted.

INORGANIC AND PHYSICAL CHEMISTRY

48962 (K/ET—252) **Some considerations in the handling of fluorine and the chlorine fluorides.** Farrar, R.L. Jr.; Barber, E.J. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 10 Jul 1979. Contract W-7405-ENG-26. 46p. Dep. NTIS, PC A03/MF A01.

This paper reviews many considerations in the safe handling of fluorine and the chlorine fluorides. The physical, chemical, and toxicological properties of the materials are reviewed. Proper choice of materials of construction and materials in contact with the active gases are considered. The survey includes safe practices in design and operation of experiments and processes. Soda lime traps and caustic scrubbing are reviewed for fluorine disposal methods. Finally some explosive reactions and explosive situations are discussed.

CHEMICAL AND PHYSICOCHEMICAL PROPERTIES

REFER ALSO TO CITATION(S) 48657

48963 (DOE/W-7405-eng-26—T1) **Systematic study of metal ion sorption on selected geologic media. Sesquiannual report, April 1977—September 1978.** Meyer, R.E. (comp.). (Oak Ridge National Lab., TN (USA)). May 1979. Contract W-7405-ENG-26. 99p. Dep. NTIS, PC A05/MF A01.

This report summarizes results of the first year and a half of a research program on equilibria of inorganic ions between selected minerals and aqueous solutions covering a wide range of composition. The work is motivated by needs of information for enhanced oil recovery and isolation of nuclear waste, as well as by interest in the fundamental chemistry. Emphasis during the period has been on development of techniques; adsorption of alkali metal ions, alkaline earth ions, and rare earth ions on clays, particularly montmorillonite, and determination of the extent to which behavior can be correlated by ideal ion-exchange equations; canvass of effects of purification of minerals and of differences in properties between natural samples from different sources; evaluation of divalent transition element ions as tracers for underground water flow; and adsorption measurements of certain actinides of particular importance in nuclear wastes. 29 tables, 37 figures.

48964 (JUEL—1559) **Adsorption and reduction of nitric oxide on platinum surfaces.** Pirug, G. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Grenzflaechenforschung und Vakuumphysik; Technische Hochschule Aachen (Germany, F.R.)). Dec 1978. 103p. (In German). Dep. NTIS (US Sales Only), PC A06/MF A01.

As an introduction, the experimental measuring methods and equipment and the characterization of pure Pt(100) surfaces are described. After this, NO adsorption on Pt(100) surfaces is dealt with. For this the chemical bonding state, r.e. molecular adsorption of NO, dissociation of molecular adsorbed NO, dissociated adsorption, adsorption kinetics and structure, and binding configuration are discussed. The reduction of NO by H_2 in polycrystalline Pt surfaces is dealt with, and adsorption, desorption isothermal decomposition, and the NO + H_2 reaction are described in detail.

48965 (LA—7724-M) **QIKMIX: a quick-turnaround computer program for computing opacities of mixtures.** Abdallah, J. Jr.; Huebner, W.F. (Los Alamos Scientific Lab., NM (USA)). May 1979. Contract W-7405-ENG-36. 12p. Dep. NTIS, PC A02/MF A01.

QIKMIX is a quick-turnaround computer code developed to compute the radiative Rosseland mean opacity of specified mixtures at specified temperature and density points. The QIKLIB data base, which QIKMIX uses, has been derived from the OPLIB library. For most mixtures, QIKMIX can compute opacities over a temperature range of 50 to 25,000 eV in less than 1 min of CDC 7600 computer time. The purpose of this report is to discuss the QIKLIB data base and the operation of the QIKMIX code.

48966 (MLM—2627(OP)) **Surface studies of an aluminum/cuprous oxide thermite mixture by x-ray photoelectron and Auger spectroscopies. I. Studies of aluminum.** Moddeman, W.E.; Rengan, A.; Wang, P.S.; Haws, L.D. (Dayton Univ., OH (USA). Research Inst.; Dayton Univ., OH (USA). School of Engineering; Monsanto Research Corp., Miamisburg, OH (USA)). 1979. Contract EY-76-C-04-0053. 20p. (CONF-790207—6). Dep. NTIS, PC A02/MF A01.

From 10. symposium on explosives and pyrotechnics; San Francisco, CA, USA (14 Feb 1979).

Thermite is a name given to a mixture of powdered metal and a metallic oxide. The thermite under examination was a powdered mixture of aluminum metal and cuprous oxide in a mole ratio of 2:3. The surface chemistries of the powdered aluminum and the thermite mixture were examined by the surface analysis techniques of x-ray photoelectron spectroscopy (XPS) and high resolution Auger electron spectroscopy (AES). Surface characterization with XPS and AES found the presence of carbon and aluminum oxide on the aluminum reactant and mixtures. A surface oxide thickness of 9.8 A was measured for room temperature stored powdered aluminum metal. The aluminum oxide thickness on the aluminum powder was noted to be larger for room temperature aged thermite powder (10.5 A) and a thermite pressed pellet (22 A). All oxide thicknesses were found to be larger when aged in dry air or argon at an elevated temperature of 180°C. The largest oxide thickness measured was 26 A. Carbon contaminant levels were measured and were found to decrease from 64 A for room temperature stored metal to 34 A for metal stored at 180°C.

48967 (RFP—2849) **Evaluation of reaction kinetics for gas-powder systems.** Stakebake, J.L.; Bixby, G.E. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 25 Jun 1979. Contract EY-76-C-04-3533. 25p. Dep. NTIS, PC A02/MF A01.

Kinetic models for the reaction between a gas and powder are presented and discussed. Rates from the progressive conversion model are dependent on the amount of material present. This model

is described by an equation that yields both the rate constant and the reaction order. The phase boundary model produces rates for topochemical reactions which are dependent on the powder surface area. Applications of these models to uranium powder hydriding are discussed. Computer programs for analyzing data also are included. 6 figures.

48968 Thermodynamics of electrolytes. 12. Dielectric properties of water and Debye—Hueckel parameters to 350°C and 1 kbar. Bradley, D.J.; Pitzer, K.S. (Univ. of California, Berkeley). *J. Phys. Chem.;* **83**: No. 12, 1599-1603(14 Jun 1979).

In preparation for work with aqueous electrolytes at above saturation pressures and at temperatures to 350°C, an equation was developed for the representation of the dielectric constant of water over this range. With this equation and an equation of state for water, the Debye—Hueckel limiting law parameters for osmotic and activity coefficients, enthalpies, heat capacities, volumes, compressibilities, and expansibilities were calculated and are presented. 5 figures, 4 tables.

48969 Theoretical study on the electron affinity of the water dimer. Chipman, D.M. (Univ. of Notre Dame, IN). *J. Phys. Chem.;* **83**: No. 12, 1657-1662(14 Jun 1979).

Ab initio SCF calculations on properties of an isolated dimer of the water molecule are reported. The calculated geometry and force constants of the neutral dimer are in good agreement with other calculations and, where comparisons are possible, with experiment. The dipole moment and ionization potentials are also reported. This work represents the first realistic attempt at a quantitative determination of the electron affinity of the water dimer. It is found that the neutral dimer and its anion have virtually identical equilibrium geometries and force constants. The excess electron is in a very diffuse orbital, being weakly bound by the long-range dipole field of the neutral molecule. The calculated vertical electron affinity at the equilibrium geometry is only 0.0002 eV. Other points on the potential surface show much higher vertical electron affinities (the highest being 0.009 eV) and indicate that vibrational excitation will cause the experimental electron affinity to have a significant temperature dependence. 1 figure, 3 tables.

48970 Purification of silane via laser-induced chemistry. Clark, J.H.; Anderson, R.G. (to Dept. of Energy). US Patent 4,146,449. 27 Mar 1979. Filed date 28 Dec 1977. 6p.

PAT-APPL-865,348.

Impurities such as PH_3, AsH_3, and B_2H_6 may be removed from SiH_4 by means of selective photolysis with ultraviolet radiation of the appropriate wavelength. An ArF laser operating at 193 nm provides an efficient and effective radiation source for the photolysis.

ORGANIC CHEMISTRY

CHEMICAL AND PHYSICOCHEMICAL PROPERTIES

REFER ALSO TO CITATION(S) 49321

48971 (AD-A—060966) **Homonuclear dipolar-modulated chemical shift spectra in polycrystalline solids: the proton chemical shift tensor in CCl_3COOH. Technical report.** Stoll, M.E.; Vega, A.J.; Vaughan, R.W. (California Inst. of Tech., Pasadena (USA). Div. of Chemistry and Chemical Engineering). Oct 1976. Contract N00014-75-C-0960. 23p. NTIS PC A02/MF A01.

A single resonance, multiple pulse nuclear magnetic resonance experiment is proposed and demonstrated which produces a homonuclear dipolar modulation of a chemical shift powder pattern. The correlation generated between the homonuclear dipolar Hamiltonian and the chemical shift Hamiltonian can be used to determine the relative orientation of the chemical shift principal axis frame to the molecular frame. The experimental scheme is applied to determine the orientation of the proton-proton vector in a CCl_3COOH dimer relative to the chemical shift tensor of the hydrogen-bonded proton.

48972 Direct mass spectrometric study of the mechanism of toluene pyrolysis at high temperatures. Smith, R.D. (Battelle Pacific Northwest Labs., Richland, WA). Contract EY-76-C-06-1830. *J. Phys. Chem.;* **83**: No. 12, 1553-1563(14 Jun 1979).

The detailed mechanism of the high-temperature pyrolysis of toluene has been studied over a large range of pressures and temperatures by using mass spectrometric techniques. The vapors leaving a high-temperature Knudsen cell equipped with a gas inlet line were examined by using modulated molecular beam mass spectrometric techniques. The pyrolysis products from both quartz and tungsten Knudsen cells were examined over a pressure range of 10^{-5} to 1 torr and temperatures up to 1800°C. At the lower pressures, only products with molecular weights lower than C_7H_8 were observed, including CH_3, C_2H_2, C_3H_3, C_4H_2, C_4H_3, C_4H_4, C_5H_5, C_6H_6, and C_7H_7. At higher pressure, these products undergo bimolecular processes to form heavier compounds, up to at least $C_{20}H_{12}$. To help define the reaction mechanism, the pyrolyses of $C_6H_5{}^{13}CH_3$ and $C_6H_5CD_3$ were also studied, as well as toluene in the presence of H_2, C_2H_2, and C_6H_6. These studies allowed an unambiguous determination of most of the major processes occurring during toluene pyrolysis. 7 figures, 6 tables.

48973 Detection of transient species by measurement of dielectric loss. Fessenden, R.W.; Carton, P.M.; Paul, H.; Shimamori, H. (Univ. of Notre Dame, IN). *J. Phys. Chem.;* **83**: No. 12, 1676-1677(14 Jun 1979).

This communication pointed out that the absorption of microwave energy to detect ions in gas, liquid and solid phases and to measure certain of their properties and reaction kinetics is not limited to the detection of ions and that other chemical changes such as those giving rise to changes in molecular dipole moment will also affect the absorption of microwaves. The microwave circuit of an ESR spectrometer was used for the experiment. The system studied was 2mM duroquinone (DQ) and 1mM of the corresponding hydroquinone (H_2DQ) in cyclohexane. The results show that dielectric loss measurements can be made on transients for both kinetic and structural studies. 1 figure.

ELECTROCHEMISTRY

REFER ALSO TO CITATION(S) 48893, 48898, 48961

PHOTOCHEMISTRY

48974 (BNL—26111) **Laser photodetachment spectra of $C_6F_6^-$ in nonpolar liquids.** Sowada, U.; Holroyd, R.A. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 29p. (CONF-790662—1). Dep. NTIS, PC A03/MF A01.

From 5. international conference on excess electrons and metal-ammonia solutions; Iverness-Shire, UK (25 Jun 1979).

Aromatic anions absorb in the visible region of the spectrum and energetic considerations suggest that in solution photodetachment may be an important process at these wavelengths. This study reports electron photodetachment cross sections for $C_6F_6^-$ for wavelengths between 415 and 700 nm. The anion is generated by electron attachment to solute C_6F_6 during an x-ray pulse. Detachment is observed as a change in conductivity induced by a subsequent light pulse from a tunable dye laser. The threshold values are reported for tetramethylsilane, n-butane, cyclopentane, n-pentane, 2,2,4-trimethylpentane, 2,2 dimethylbutane, and neopentane. The thresholds are consistent with an electron affinity of 1.09 +- 0.04 eV for the C_6F_6 molecule. Comparison of the data to the absorption spectrum of $C_6F_6^-$ shows that for photon energies above threshold the major process is photodetachment. The relationship of photodetachment data to other properties of the excess electrons in these solvents are discussed.

48975 (MIT—2793) **Nonequilibrium photochemical reactions induced by lasers. Technical progress report.** Steinfeld, J.I. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemistry). 15 Jan 1979. Contract EY-76-S-02-2793. 84p. Dep. NTIS, PC A05/MF A01.

Infrared double resonance spectroscopy was carried out on SF_6 molecules excited with a CO_2 laser, using a tunable diode laser as the probe source. Power broadening induced by the pump beam, transitions in the $\nu_3 \rightarrow 2\nu_3$ manifold, and relaxations within the ν_3 vibrational level brought about by collisions between SF_6 and other molecules of SF_6, He, and CH_3F were observed. Results indicate that rotational broadening of the excited-state absorption band envelopes may play a significant role in anharmonicity compensation, and that rotational relaxation proceeds mainly by collisions which reorient the angular momentum with respect to the internal coordinates of the SF_6 molecule, but leave the total J quantum number nearly unchanged. Progress is also reported in the study of reactions induced by multiple infrared photon excitation. The dehydrohalogenation of $R_2C = CHCl$ systems (R = H, CH_3, F) has been examined for the vinyl carbene ($R_2C = C$:) intermediate. Several theoretical aspects of the problem have been examined, including the effect of using various distribution functions in RRKM models of the multiphoton dissociation process, and an analysis of energy deposition in absorbing samples by focused Gaussian beams.

48976 (ORO—6035-1) **Hypersonic beam laser photolysis. Technical progress report, July 15, 1978 to April 15, 1979.** Smalley, R.E. (Rice Univ., Houston, TX (USA)). 1979. Contract ER-78-S-05-6035. 9p. Dep. NTIS, PC A02/MF A01.

Substantial accomplishments have been achieved in three major areas: (1) the photolysis-probe laser system; (2) the pulsed

beam apparatus; and (3) initial laser photolysis experiments on ketene to produce the methylene radical.

RADIATION CHEMISTRY

REFER ALSO TO CITATION(S) 48192, 48969, 48974

RADIOCHEMISTRY AND NUCLEAR CHEMISTRY

REFER ALSO TO CITATION(S) 49164

48977 (COO—1167-41) **Annual progress report on nuclear chemistry research, February 1, 1979—January 31, 1980.** Turkevich, A. (Chicago Univ., IL (USA). Enrico Fermi Inst.). 15 Jan 1979. Contract EY-76-S-02-1167. 18p. Dep. NTIS, PC A02/MF A01.

The prinicpal effort during this contract period was directed toward preparing for on-line radiochemical experiments at LAMPF directed toward studying rare processes such as (π^-, π^+), (n, Δ^{++}) and (μ^-, e^+) in ^{89}Sr. Chemical scavenging techniques to remove interfering products were shown to be effective without significantly affecting the sensitivity of the detection system. Sensitivities of less than 0.1 μb for the first two processes appear achievable. Detailed statistical analysis of last years' experiments is leading to new limits, about an order of magnitude lower than already reported, on the formation of polyneutrons, reinforcing the conclusion that such species are not particle stable. 100 GeV π^- studies of copper spallation are revealing no dramatic differences between spallation with pions and that with protons. Essentially, this report consists of a collection of abstract-like summaries.

PROPERTIES OF RADIOACTIVE MATERIALS

REFER ALSO TO CITATION(S) 48177

48978 **Reduction of pertechnetate-99 by stannous chloride. 2. The stoichiometry of the reaction in aqueous solutions of several phosphorus(V) compounds.** Steigman, J.; Meinken, G.; Richards, P. (Brookhaven National Lab., Upton, NY (USA)). *Int. J. Appl. Radiat. Isot.;* **29**: No. 11, 653-660(Nov 1978).

Most radiopharmaceutical preparations containing ^{99}Tcsup(m) require the reduction of pertechnetate by a reducing agent, usually in large excess. The present article deals mainly with the reduction of $Na^{99}TcO_4$ by $SnCl_2$ in orthophosphate and in pyrophosphate solutions near or at pH 7. Coulometric, polarographic and spectrophotometric measurements are reported. These yielded an approximate idea of the oxidation state of ^{99}Tc in orthophosphate solution after reduction by excess of $SnCl_2$, and a somewhat less precise knowledge of its oxidation state in pyrophosphate solution after a similar reduction. In addition, the relative stabilities of $SnCl_2$-produced polyphosphate and pyrophosphate complexes were determined qualitatively. Finally, preliminary results on the oxidation state of the ^{99}Tc-diphosphonate complex are reported.

ENGINEERING

REFER ALSO TO CITATION(S) 48749

FACILITIES AND EQUIPMENT

REFER ALSO TO CITATION(S) 48123, 49115

48979 (AD—875425) **Evaluation of high-pressure airblast attenuation effectiveness of air entrainment subsystems. Final report.** Gill, S.P.; Moore, E.T.; Randall, D.; Gross, M. (Physics International Co., San Leandro, CA (USA)). Apr 1970. Contract N62399-70-C-0003. 61p. NTIS PC A04/MF A01.

The report describes the results of a test in which four air entrainment subsystem (AES) conceptual models were exposed to a simulated nuclear airblast at 3000-psi overpressure. The BOSS explosively driven blast simulator was used to generate a blast wave pressure-time profile closely matching one-ninth scale of a 1-Mt nuclear burst in a 7-in. by 28-in. rectangular blast duct 100-ft long. AES models were welded to the blast duct and instrumented with piezoelectric pressure gauges. Results include pressure-time histories at blast valve locations and accumulator stations, and observations of model component failure modes. This test represents the first time that sub-scale air entrainment subsystems have ever been exposed to blast waves in air at high overpressure levels, and the results indicate substantial differences between predicted and measured pressures.

48980 (SAND—79-0411C) **Aerodynamic coefficient estimation by means of an extended Kalman filter.** Kelsey, J.R.; Petersen, D.P. (Sandia Labs., Albuquerque, NM (USA); New Mexico Univ., Albuquerque (USA)). 1979. Contract EY-76-C-04-0789. 19p. (CONF-790826—1). Dep. NTIS, PC A02/MF A01.

From Atmospheric flight mechanics conference; Boulder, CO, USA (6 Aug 1979).

An extended, augmented Kalman filter is used to study several dynamic models of vehicle motion aimed at estimating the aerodynamic moment coefficients. These models consider various state representations as well as various measurement sets. Linear and cubic symmetric moments are considered as well as linear asymmetric moments. Computer generated data representative of a reentry vehicle flight are used as the simulated measurement information. Coefficient estimates and error estimates are given for each of the models studied. The computer time required for estimate convergence is also shown, indicating that near-real-time estimation is possible.

48981 (TAC-HP—79-001) **Heat pipe technology: a bibliography with abstracts. Quarterly update, January—March 1979.** (New Mexico Univ., Albuquerque (USA). Technology Application Center). Jun 1979. 75p. Technology Application Center, Albuquerque, NM.

This is the first quarterly update for 1979 in the Heat Pipe Technology Bibliographic Series. This quarter mainly contains publications on applications and theory. Because of an unusual large number of publicatios on applications, the second section of this Bibliography is divided into seven subsections instead of five. These include general applications and heat pipe uses for energy conversion, and conservation, solar and nuclear energy systems applications, aerospace utilization, and the cooling of electrical equipment.

48982 (UCRL—82131) **Turbulent dusty gas motions with weak statistical coupling.** Buckingham, A.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 May 1979. Contract W-7405-ENG-48. 23p. (CONF-790704—1). Dep. NTIS, PC A02/MF A01.

From 12. AIAA fluid and plasma dynamics conference; Williamsburg, VA, USA (24 Jul 1979).

Computer simulations are used to describe the random motions and resulting dispersal of gas borne particulates in turbulent internal ballistics flow. Force, energy and motion coupling between particles and gas is assumed weak, with negligible back-influence from particles to gas flow structure; thereby restricting present results to relatively low mass loading. Individual particle-to-gas relative velocities are obtained at incremental time steps by randomization subject to the constraint that their ensemble averaged motions are consistent with the locally computed turbulent intensity. Influence of the particles on turbulent transport and wall erosion is discussed.

48983 (UCRL—82468) **Calibration techniques.** Nelson, G.O. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 May 1979. Contract W-7405-ENG-48. 20p. (CONF-790832—1). Dep. NTIS, PC A02/MF A01.

From 4. biennial Boulder symposium; Boulder, CO, USA (6 Aug 1979).

Preparing known concentrations of gas and vapor in air is an important function in any industrial hygiene laboratory. Two systems for generating gas or vapor mixtures are compared: the simple static system and the more complex dynamic system. A completely automated dynamic system that controls the flow, temperature, humidity, and concentration of a gas or vapor mixture is also described.

48984 **New high frequency generators, an energy source for the industrial heating of metals.** Gronemann, H.J.; Meiners, G. (Siemens A.G., Erlangen (Germany, F.R.). Geraetewerk); Zureich, J. (Siemens A.G., Erlangen (Germany, F.R.). Bereich Verarbeitende Industrie). *Siemens-Z.;* **52**: No. 12, 658-661(Dec 1978). (In German).

High frequency generators are used more and more in the field of industrial electric heating. A preferrred field of application is the high frequency longitudinal seam welding of tubes. The requirement for HF heat output, short erection times, easy maintenance, high availability and service life, but not least, new tubes, particularly suitable for industrial, use lead to the development of a new series of HF generators.

48985 **Method for forming or bonding a liner.** Prevender, T.S. (to Dept. of Energy). US Patent A 927,237. 24 Jul 1978. 10p.

A process and means for forming or bonding a liner to a shell or element is presented wherein the liner is filled with or immersed in water and a portion of the water is frozen.

48986 **Influence of flap pressure on the fracture of straight pipes.** Emery, A.F.; Love, W.J.; Kobayashi, A.S. (Univ. of Washington, Seattle). pp 67-81 of Fluid structure interaction phenomena in pres-

sure vessel and piping systems. Au-Yang, M.K.; Brown, S.J. Jr. (eds.). New York, NY; American Society of Mechanical Engineers (1977).

From Winter annual meeting of the American Society of Mechanical Engineers; Atlanta, GA, USA (27 Nov 1977).

Dynamic extension of an axially oriented through crack in a pressurized pipe is a function of the fluid pressure in the zone of the crack tip. Pressure transient computations have historically been based upon leakage modified, axisymmetric, one dimensional constitutive flow equations which do not predict the circumferential pressure gradient in the crack flap region. Crack motion was studied numerically for various limit conditions of circumferential flap pressure. Computations were made using circumferential pressure distribution models which were based upon steady state radial flow momentum analysis and reported experimental data. The results indicate that the historical use of an axisymmetric linear pressure distribution on the crack flap results in a conservative (higher velocity) prediction of crack motion.

CRYOGENIC AND SUPERCONDUCTING EQUIPMENT AND DEVICES

REFER ALSO TO CITATION(S) 48543, 48895, 48897, 49387, 49388, 49389, 49390, 49393, 49394, 49395, 49396

48987 (LA—7494) **Critical boiling, vapor block, and prospects for single-sweep training of superconducting solenoids.** Sydoriak, S.G. (Los Alamos Scientific Lab., NM (USA)). Jul 1979. Contract W-7405-ENG--36. 30p. Dep. NTIS, PC A03/MF A01.

Data of seven groups who have measured steady-state critical nucleate boiling heat flux (CHF) from a channel wall to helium flowing at known mass flux G are correlated to +- 13%. None of the plots shows any trend in CHF deviation with respect to six relevant experimental variables. To achieve quench control in a partially quenched, multichanneled, straight solenoid, the average mass flux anti G must exceed G to avoid vapor block in the quench-affected channels. Equations derived for anti G/G are based on both laminar- and turbulent-flow models. In a proposed method of quench control, every miniquench, MQ (involving up to one full turn of the conductor), that exists in the absence of another MQ in one or more of its channels is automatically suppressed by maintaining a calculable coolant flow provided by an immersed circulating pump in parallel with the magnet channels. Two MQs that involve the same channel can be eliminated by a rapid doubling of mass flux. On the basis of the observed frequency of such double MQs, the pump rate can be held low enough to reduce nearly to zero the probability that three MQs will involve the same channel simultaneously. Prospects for single-sweep training free of current reversals are enhanced by the fact that in typical forced-flow boiling, as contrasted to typical pure boiling, the first (breakaway) and second (recovery) CHFs are identical. The available transient mass flux at onset of a quench is also superior to that for both pool boiling and natural convection boiling because it exceeds the planned-for steady-state value.

48988 (LA—7848-PR) **Low temperature physics and engineering. Quarterly progress report, January 1—March 31, 1979.** Keller, W.E. (comp.). (Los Alamos Scientific Lab., NM (USA)). May 1979. Contract W-7405-ENG-36. 49p. Dep. NTIS, PC A03/MF A01.

This report summarizes the significant progress achieved in several programs carried out in the Los Alamos Scientific Laboratory's Low Temperature Physics and Cryogenic Engineering Group (Q-10) during the period January 1 to March 31, 1979. Progress is documented for the following areas: assessment of problem areas in hydrogen energy delivery systems; superfluid helium hydrodynamics; equation of state of helium at higher pressure; helium—tritium complex formation; magnetic studies of solids at low temperature; muon spin rotation studies; experiments dealing with the destruction of superconductivity by current; nondestructive electric field probe; electrical and cryogenic engineering tests for the development of a dc superconducting power transmission line; development of conductors, electrical control apparatus, large Dewar vessels, and magnet coils for superconducting magnetic energy storage devices, as well as designs of these units for power system stabilization; design, testing, and procurement of equipment for separating and handling large amounts of tritium—deuterium mixtures for systems to be used in conjunction with tokamak fusion reactors; and experiments leading to designs for magnetic refrigerators to be used for superconducting device applications in the electric power industry. Most of the individual reports are a fraction of a page in length; it may be assumed that completed work will be reported in the usual channels. 5 figures, 8 tables.

48989 Spectral distribution of sensitivity of a superconducting point contact. Livin, Yu.Ya.; Malov, A.D.; Nad, F.Ya. *Radiotekh. Elektron.;* **23**: No. 9, 1875-1881(Sep 1978). (In Russian).

An experimental investigation is made of the response of high-quality superconductive point contacts with characteristic voltages of 2 to 2.5 mV as dependent on frequency, voltage amplitude and noise over a wide range of variation in these parameters. Curves are plotted for the spectral distribution of the response with reference to the power absorbed in the contact enabling comparison with theory. The experimentally studied high-resistance stable superconductive point contacts have parameters close to those of ideal contacts and show high sensitivity to millimeter and submillimeter radiation. The fluctuation temperature sensitivity determined with respect to blackbody radiation was 0.01 K/Hz/sup 1/2/ for a contac. with R = 210 Ω. Recommendations are made on optimizing the signal-to-noise ratio that determines the sensitivity of these contacts. In the case of low-frequency radiation ($f < 2$ eV/h) the response is proportional to d^2V/dI^2, and noise, to dV/dI.

48990 Heat transfer system using thermally-operated, heat-conducting valves. Hudson, G.E. III; Clark, A.E. US Patent 4,112,699. 12 Sep 1978. Filed date 4 May 1977. 6p.

This patent discusses a heat transfer system, e.g., refrigeration system or heater, particularly valuable at cryogenic temperatures which comprises a serial arrangement, in abutting contact and connected to the material or device to be cooled or heated, of a thermal reservoir made of a material having a specific heat capacity, a thermal valve made of a thermally-conductive material whose thermal conductivity increases as its temperature increases, e.g., magnesium, a working material whose temperature is periodically varied, e.g., by magnetic or electric fields, and another valve of a thermal-conductive material whose thermal conductivity decreases as its temperature increases, e.g., NaCl. The magnetic refrigeration or heater units may be ganged to increase the cooling or heating ability.

48991 Longitudinal electric field in superconductors. Artemenko, S.N.; Volkov, A.F. *Radiotekh. Elektron.;* **23**: No. 9, 1865-1974(Sep 1978). (In Russian).

An examination is made of the depth of penetration of a longitudinal electric field in a system made up of a normal metal and a superconductor when direct current flows through this system. It is shown that the field penetrates into the superconductive region to a microscopic depth in the superconductor. It is also shown that when there is a temperature gradient in the system, the superconductive region contributes to the thermo-emf. The spectrum of fluctuations of the electric field in the superconductor is calculated. Near the critical temperature, these fluctuations are weakly damped and have an acoustic spectrum.

48992 Proceedings of the seventh international cryogenic engineering conference. Guildford, England; IPC Science and Technology Press (1978). 749p. (CONF-780718—). IPC Science and Technology Press, Guildford, Surrey, England.

From 7. cryogenic engineering conference; South Kensington, London, UK (4 Jul 1978).

Separate abstracts were prepared for each of the 51 included papers. (MOW)

48993 Transient loss analysis and measurements on normal conductors and composite superconductors. Shen, S.S.; Schwall, R.E. (Oak Ridge National Lab., TN). pp 659-666 of Proceedings of the seventh international cryogenic engineering conference. Guildford, England; IPC Science and Technology Press (1978).

From 7. cryogenic engineering conference; South Kensington, London, UK (4 Jul 1978).

An equivalent circuit technique is presented for calculation and measurement of eddy current losses in conductors under transient external fields. It is demonstrated that such techniques can yield satisfactory results through a much simpler mathematical process than that encountered in the conventional field theory. Experimental techniques and results of transient loss measurements on both normal conductors and superconducting composites are presented to verify the model and explore its limits.

48994 Cryostatic influence of formvar coatings on sizing of the stabilizer in composite NbTi—Cu superconductors. Caspi, S.; Lee, J.Y.; Kim, Y.I.; Frederking, T.H.K. (Univ. of California, Los Angeles). pp 667-672 of Proceedings of the seventh international cryogenic engineering conference. Guildford, England; IPC Science and Technology Press (1978).

From 7. cryogenic engineering conference; South Kensington, London, UK (4 Jul 1978).

Often undesirable low energy densities are associated with extreme safety measures (e.g., cryostatic stability) in large superconducting magnets. Therefore, a medium-sized, formvar-coated composite NbTi alloy, Cu-stabilized, has been studied (48 filaments, approximately square cross section - 1/5 cm thickness). Thermal quench behavior (caused by heating) was investigated in various fluid states of He^4, including pressurized and superfluid He^4. The data obtained support existence of a particular coating thickness ("limiting" thickness) with the property that thermal boundary conditions of uncoated superconductors at a quench are not deteriorated.

PROTECTIVE STRUCTURES AND EQUIPMENT

48995 (SAND—79-0147C) **PLZT thermal/flash protective goggles: device concepts and constraints.** Cutchen, J.T. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 6p. (CONF-790670—1). Dep. NTIS, PC A02/MF A01.

From IEEE international symposium on application of ferroelectric; Minneapolis, MN, USA (13 Jun 1979).

In 1975 Sandia Laboratories began the design and development of PLZT Goggles for the US Air Force to provide protection from temporary flashblindness and permanent retinal burns caused by the brilliant flash of nuclear explosions. The user requirements, system and physical constraints, and use/storage environments were all considered in arriving at the final design goals. When the program began, there was no industrial capability to manufacture large-aperture PLZT materials or bonded lens assemblies. The technology has been established from a laboratory baseline in a brief period, and operational testing and evaluation by the Air Force has been completed. The goggles, identified as the EEU-2/P,, are now in production.

SHIPPING CONTAINERS

REFER ALSO TO CITATION(S) 48238

48996 (HEDL-TME—78-105) **Thermal anrlysis of a one-element PWR spent fuel shipping cask.** Fields, S.R. (Hanford Engineering Development Lab., Richland, WA (USA)). Jun 1979. Contract EY-76-C-14-2170. 49p. Dep. NTIS, PC A03/MF A01.

The transient thermal behavior of a typical one-element PWR spent fuel shipping cask, following a hypothetical accident and fire, has been simulated. The objectives of the study were to determine the transient behavior of the cask and its spent fuel primary coolant through the pressure relief system and possible fuel pin clad failure due to overheating following loss of coolant. 15 figures, 7 tables.

48997 (NUREG/CR—0699) **Leak rate tests on PC-1 plutonium product cans sealed by welding. Final report, September 1978—January 1979.** Colten, J.D.; Pettijohn, R.R. (SRI International, Menlo Park, CA (USA)). Apr 1979. 29p. NTIS, PC A03/MF A01.

The feasibility of sealing the PC-1 product can, the inner container in the plutonium air transportable (PAT) package, by welding the lid to the product can is discussed. We filled four PC-1 product cans with helium and sealed the cans by welding. A vacuum was drawn around each product can, and the leak rate of helium out of the can was measured with a mass spectrometer helium leak detector. To ensure that helium was trapped in the can after sealing, we analyzed the contents of each can with a mass spectrometer. We found that all four cans met the PC-1 equivalent air leak rate criterion specified by the Safety Analysis Report for the PAT package (leak rate less than 1×10^{-3} atm cm^3 s^{-1}). In addition, we found that three of the four cans met the leaktight criterion (equivalent air leak rate less than 1×10^{-7} atm cm^3 s^{-1}). We conclude that (1) sealing of the existing PC-1 product can by welding requires an apparatus for holding the lid on the can during welding, (2) welding of the PC-1 product can consistently results in a leak rate less than 1.0×10^{-3} atm cm^3 s^{-1} (air), (3) by welding the PC-1 product can, it is possible to obtain a leak rate of less than 1.0×10^{-7} atm cm^3 s^{-1} (air); however, the welding procedure used in these tests is not reliable for obtaining seals of this quality, and (4) it is not possible to identify leak rates of the order of 1.0×10^{-4} atm cm^3 s^{-1} (air) or smaller by standard x-ray weld inspection.

48998 (PNL—2260-10) **Study of plutonium oxide leak rates from shipping containers. Quarterly progress report, January 1—March 30, 1979.** Schwendiman, L.C.; Madia, W.J.; Mishima, J.; Sutter, S.L.; Owzarski, P.C.; Bander, T.J.; Schmidt, E.W.; Yesso, J.D. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1979. Contract EY-76-C-06-1830. 41p. Dep. NTIS, PC A03/MF A01.

The study was initiated in October 1976, as outlined in the 189 research proposal submitted previously. Several tasks are to be undertaken in this study which, when combined, have the end objective of defining the leak rates of plutonium oxide powder from characterized leaks. Progress during the reporting period is briefly described on the following tasks: review of the literature and theoretical work relating to transmission of particles through channels; investigation of the relationship of gas flow rates, leak geometries, pressure and temperatures; measurement of the transmission of a well-characterized simulant (UO_2 powder) through leaks characterized in Task B; measurement of the fuel grade PuO_2 leaks through a standard leak incorporated into a suitable container; and investigation of PuO_2 leaks through simulated defected containers. (TFD)

MINING AND DRILLING EQUIPMENT AND FACILITIES

REFER ALSO TO CITATION(S) 48078, 48079

48999 **Safety valve hydraulically operated by telescopic drill stem movement.** Nutter, B.P. (to Schlumberger Technology Corp.). US Patent 4,141,418. 27 Feb 1979. Filed date 6 Sep 1977. 8p.

In accordance with an illustrative embodiment of the present invention as disclosed herein, a combination slip joint-safety valve tool includes telescoping mandrel and housing members, a full-opening valve on the housing member operable when closed to prevent upward flow of fluid through said members, and hydraulically operable valve actuator means responsive to contraction of said telescoping members for closing said valve and to extension of said members for opening said valve.

LASERS

REFER ALSO TO CITATION(S) 49335, 49357

49000 (AD-A—059163) **An investigation of a magnetron injection gun suitable for use in cyclotron resonance masers. Memorandum report.** Seftor, J.L.; Drobot, A.T.; Chu, K.R. (Naval Research Lab., Washington, DC (USA)). Jul 1978. 33p. NTIS PC A03/MF A01.

The requirements of an electron beam source suitable for use in cyclotron resonance masers are discussed. The beam source of preference, a temperature limited, magnetron injection gun, is studied by use of a numerical simulation code. This computer code includes the effect of external magnetic fields, the beam's azimuthal self magnetic field, and space charge in a self consistent manner. By use of this program, a prediction of gun operation, particularly as it affects gyrotron performance, can be made. Of particular interest are the effects of varying such control parameters as the magnitude of the electric and magnetic fields, the shape of the electric and magnetic fields, and the current. It is demonstrated that, for a particular optimized gun design, the gun operation is very sensitive to both the applied electric and magnetic fields at the cathode. However, the gun shows no strong dependence on other factors such as the temperature limited beam current or the magnetic field taper used to compress the beam.

49001 (LA-UR—79-1032) **Aplanatic waxicons.** Minerbo, G.N. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 6p. (CONF-790529—1). Dep. NTIS, PC A02/MF A01.

From Conference on Optics; Los Alamos, NM, USA (23 May 1979).

Waxicon mirror components offer many advantages in designing optical systems for transporting high power laser beams. The widespread use of waxicons has been limited because of their high sensitivity to tilt errors. This paper gives the equations of the surfaces of a waxicon that is rigorously corrected for both spherical aberration and coma. Computer ray tracing has confirmed its low sensitivity to tilt errors: if the aplantic waxicon as a whole is tilted by a small angle δ, the RMS wavefront error in the output beam will be proportional to δ^2.

49002 (LA-UR—79-1203) **High-energy, short-pulse, carbon-dioxide lasers.** Fenstermacher, C.A. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 26p. (CONF-790558—1). Dep. NTIS, PC A03/MF A01.

From Ultra short laser pulses meeting; London, UK (23 May 1979).

Lasers for fusion application represent a special class of short-pulse generators; not only must they generate extremely short temporal pulses of high quality, but they must do this at ultra-high powers and satisfy other stringent requirements by this application. This paper presents the status of the research and development of carbon-dioxide laser systems at the Los Alamos Scientific Laboratory, vis-a-vis the fusion requirements.

49003 (UCRL—15047) **Step-by-step approach to convective cooling of laser disc amplifiers.** Bourque, R.F. (General Atomic Co., San Diego, CA (USA)). Apr 1979. Contract W-7405-ENG-48. 40p. Dep. NTIS, PC A03/MF A01.

A step by step approach is presented to the problem of gas cooling of laser glass amplifiers. The basic equations are given for glass conduction, thermal stress, gas convection, and heat exchanger and blower design. An example calculation is then carried out for helium gas at one atmosphere with the gas flow in the direction orthogonal to the optical path. It is found that pumping powers and temperatures are acceptable for this case. Results are also presented for helium in the slant direction and for nitrogen in both directions. Included also are the effects on pumping power of gas temperature rise, gas pressure, flashtube rep rate, and flow channel width. It is found that, based on temperature rise and pumping power, nitrogen is as viable a coolant as helium.

HEAT TRANSFER AND FLUID FLOW

REFER ALSO TO CITATION(S) 48096, 48990

49004 (CONF-790655—4) **Imaging optical probe for pressurized steam-water environment.** Donaldson, M.R.; Pulfrey, R.E. (Idaho National Engineering Lab., Idaho Falls (USA)). 1979. Contract EY-76-C-07-1570. 52p. Dep. NTIS, PC A04/MF A01.

From Colloquium on two-phase instrumentation; Idaho Falls, ID, USA (11 Jun 1979).

An air-cooled imaging optical probe, with an outside diameter of 25.4 mm, has been developed to provide high resolution viewing of flow regimes in a steam-water environment at 343°C and 15.2 MPa. The design study considered a 3-m length probe. A 0.3-m length probe prototype was fabricated and tested. The optical probe consists of a 3.5-mm diameter optics train surrounded by two coaxial coolant flow channels and two coaxial insulating dead air spaces. With air flowing through the probe at 5.7 g/s, thermal analysis shows that no part of the optics train will exceed 93°C when a 3-m length probe is immersed in a 343°C environment. Computer stress analysis plus actual tests show that the probe can operate successfully with conservative safety factors. The imaging optical probe was tested five times in the design environment at the semiscale facility at the INEL. Two-phase flow regimes in the high temperature, high pressure, steam-water blowdown and reflood experiments were recorded on video tape for the first time with the imaging optical probe.

49005 **Spectral and probability-density nature of square-prism separation—reattachment wall pressures.** Wedding, J.B. (Colorado State Univ., Fort Collins); Robertson, J.M.; Peterka, J.A.; Akins, R.E. *J. Fluids Eng.;* **100**: No. 4, 485-492(Dec 1978).

From Winter annual meeting of the fluids engineering division of the ASME; San Francisco, CA, USA (10 Dec 1978).

The statistical nature of the fluctuating pressures associated with the separation—reattachment flow were studied for a two-dimensional square prism in uniform flow for low (0.33 percent) and high (10.4 percent) turbulence levels. Studies were also made with a splitter plate to inhibit the feedback effect arising from vortex shedding. The nature of the separation—reattachment flow was characterized by use of the measured value of the mean and fluctuating pressure fields. Spectral distribution of the unsteady pressures reveals strong energy spikes at the Strouhal frequency which are eliminated by the presence of the splitter plate. Probability density distributions indicate appreciably non-Gaussian nature only in the wake. Additional information is presented on the variation with angle of the Strouhal frequency for the wake flow.

49006 **Freezing-melting heat transfer in a tube flow.** Yim, A.; Epstein, M.; Bankoff, S.G.; Lambert, G.A.; Hauser, G.M. (Argonne National Lab., IL (USA)). *Int. J. Heat Mass Transfer;* **21**: No. 9, 1185-1196(Sep 1978).

Consideration is given to the heat-transfer problem involving solidification of a flowing liquid into a melting wall. In particular, an experimental study of hot Freon 112A (m.p. 40.50°C) in turbulent flow though a thick ice pipe has been carried out. The major emphasis was on the melting attack of the ice pipe wall by the flowing Freon. The effects of both Freon injection pressure and temperature on the amount of melted ice collected at the pipe exit for a fixed injection period were investigated. The shape of the melted ice channel as a function of time, injection pressure and Freon temperature was determined from the frozen Freon casting that remained in the ice pipe. Numerical results based on a simple quasi-steady melting model were compared with the experimentally determined ice melting results. The model was found to represent the data reasonably well for Freon temperatures above 70°C, indicating that the ice wall melting process is controlled by the growth and decay of frozen Freon layers on the ice pipe wall.

MATERIALS TESTING

REFER ALSO TO CITATION(S) 48042, 48918

ELECTRONIC CIRCUITS AND DEVICES

REFER ALSO TO CITATION(S) 49063, 49064, 49335

49007 (COO—4094-56) **Unifying derivation of switching dc-dc converter topologies.** Landsman, E.E. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 1979. Contract EY-76-C-02-4094. 5p. (CONF-790689—1). Dep. NTIS, PC A02/MF A01.

From 1979 power electronics specialists conference; San Diego, CA, USA (19 Jun 1979).

A canonical switching cell is proposed from which the three basic dc-dc converter topologies can be derived. In addition, it is possible to perform topological transformations which yield apparently new topologies. Upon examination, however, these topologies may prove to be identical to existing basic topologies. An optimum topology converter recently described by Cuk, et al., is shown to be a transformation of a basic topology.

49008 (LA—7872-PR) **E-Division semiannual report. Progress report, July 1—December 31, 1978.** Kelley, P.A. (comp.). (Los Alamos Scientific Lab., NM (USA)). Jan 1979. Contract W-7405-ENG-36. 88p. Dep. NTIS, PC A05/MF A01.

The status of the programs and projects of the Electronics Division for the period July through December 1978 is reported. The presentation is divided into three sections: Research, Engineering Support, and Technical Services. Each of these sections presents the activities and accomplishments of the corresponding branch within the Division. The primary goal of the Research and Development branch is to advance technology for future applications. The primary goal of the Engineering Support Branch is to apply advanced technology to Laboratory and material problems. The primary goal of the Technical Services Branch is to provide a technical base and support for Laboratory programs. Most of the individual reports are quite short.

COMBUSTION SYSTEMS

REFER ALSO TO CITATION(S) 48091, 48096, 48528, 48930

49009 (ORNL/TM—6878) **Effects of alternate fuels report No. 7: analysis of failure of a mullite-based refractory brick in an industrial oil-fired burner.** Federer, J.I.; Tennery, V.J. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 32p. Dep. NTIS, PC A03/MF A01.

Industrial conversion from natural gas to alternate fuels, such as residual oils and coal, often results in accelerated degradation of refractory materials due to chemical reactions with the metal impurities in the alternate fuels. The cause of failure of a refractory brick used in an industrial burner firing an alternate fuel is described. The burner, which was used to calcine $CaSO_4$ in a lime-type kiln, was fired with No. 6 residual oil. The refractory lining in the burner was constructed of aluminosilicate brick, castable, and mortar in contact with one another. The lining deteriorated after about 1000 h, during which the maximum hot-face temperature was about 1750°C. The degraded refractories were subjected to chemical analyses, ceramography, x-ray diffraction, scanning electron microscopy, and electron microprobe analysis. Liquid phases that formed in the castable and mortar during operation of the burner at temperatures above about 1600°C reacted with the brick, resulting in decomposition of mullite. Contamination of the original refractory with CaO and V_2O_5 resulted in the formation, during cooling, of compounds which are less refractory than the original castable and mortar. It was concluded that failure was initiated by melting in the castable and mortar. Large concentrations of aggressive oxide liquid were in the burner lining at the service temperature. The liquid phase eventually advanced into the refractory from the hot face to the extent that the brick grossly deteriorated. Therefore, rapid degradation of the refractory system was due to a combination of excess temperature and fluxing by process carry-over and impurities from the fuel oil.

49010 (SAN—1900-T1) **Turbulent combustion experiments and modeling. Technical progress report, August 1—December 31, 1978.** Lapp, M.; Drake, M.C.; Penney, C.M.; So, R.; Warshaw, S. (General Electric Co., Schenectady, NY (USA)). 25 Jan 1979. Contract ET-78-C-03-1900. 53p. Dep. NTIS, PC A04/MF A01.

The goal of this research effort is to advance combustion design capability through development and validation of modeling techniques for turbulent diffusion flames, based upon the use of new experimental data to be obtained from non-intrusive optical measurement techniques. During this first reporting period, the following major efforts have been accomplished: (a) completion of the basic design and initiation of construction of a new fan-induced, square-cross-section combustion tunnel; (b) analysis of Raman scattering measurements using multiple-spectral-channel (MSC) detectors, calculation of light economy for spectrometer/MSC-detector system for use in pulsed Raman scattering observations, and measurement of MSC-detector sensitivity for commercially-available unit; and (c) development of formalism for model of hydrogen/air turbulent diffusion flame.

49011 (STU—76-6942) **Manufacturing and testing of a new type of steam boiler with two-stage combustion.** Oestbo, N. (Styrelsen foer Teknisk Utveckling, Stockholm (Sweden)). Oct 1978. 63p. (In Swedish). (STU—76-3436). Dep. NTIS (US Sales Only), PC A04/MF A01.

A new type of steam boiler was tested. It utilizes two-stage combustion and has an integrated air preheater. The test results

show that the coefficient of utilization for the boiler was higher than 90% and the combustion was almost complete. Today the boiler could be used directly as a steam boiler for liquid fuel flows up to 35 ton/h.

MARINE ENGINEERING

REFER ALSO TO CITATION(S) 48326

POLLUTION CONTROL EQUIPMENT

49012 (BNL—50990) **Feasibility study on the use of a rotating fluidized bed as a dust filter.** Pfeffer, R.; Hill, F.B. (Brookhaven National Lab., Upton, NY (USA)). Sep 1978. Contract EY-76-C-02-0016. 43p. Dep. NTIS, PC A03/MF A01.

A brief survey was made of the characteristics of the rotating fluidized bed used as a filter for fine dusts and mists. A sample calculation of overall filtration efficiency was made for a rotating bed operating at minimum fluidization with a velocity of 4 m/sec and a g-loading of about 50. Account was taken of removal by the classical mechanisms of diffusion, interception, and inertial impaction. High efficiencies were found for dust particles as small as 1 μm. The rotating fluid bed filter should have approximately the same collection efficiency and pressure drop as the fixed and moving bed filters operating at the same velocity, but in addition should more readily permit continuous operation without clogging and with effective regeneration. The same sample calculation of filtration efficiency applied to the conventional 1-g fluid bed operating at 1.5 times the minimum fluidization velocity of 0.2 m/sec indicated lower collection efficiencies near 1 μm than for the rotating system. The low velocity - and corresponding low throughput - in the stationary system is required to avoid bubble formation which would tend to lower filtration efficiency because of bypassing. The possible harmful effect on filtration efficiency of reentrainment of dust particles at the high operating velocities of the rotating system as well as the helpful effect of triboelectrification will have to be determined by experiment.

49013 (UCRL—81926) **Electrostatic filters generated by electric fields.** Bergman, W.; Hebard, H.; Taylor, R.; Lum, B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 Jul 1979. Contract W-7405-ENG-48. 30p. (CONF-790907—1). Dep. NTIS, PC A03/MF A01.

From 2. World Filtration Congress; London, UK (18 Sep 1979).

The paper presents theoretical and experimental findings on fibrous filters converted to electrostatic operation by a nonionizing electric field. Compared to a conventional fibrous filter, the electrostatic filter has a much higher efficiency and significantly lower pressure drop at the same level of particle loading. It also eliminates the minimum at the same level of particle loading. It also eliminates the minimum efficiency typically seen for 0.1 to 0.3 μm dia. particles. An additional capture mechanism involving charged fibers and charged particles has been added to the previous theory for clean electrostatic filters. The paper also presents two theoretical models of filter clogging. The dendrite model simulates filter clogging of conventional fibrous filters without an electric field. The increasing fiber model simulates filter clogging with an applied electric field. There is good experimental agreement with these theories.

49014 **Automatic system for trapping and removing waste hydrocarbons from water.** Bereskin, F.P.; Borowczyk, J.J. US Patent 4,145,286. 20 Mar 1979. Filed date 1 Aug 1977. 6p.

The subject invention comprises systems for the automatic removal of waste hydrocarbons from water. Waste water enters a primary vessel through a baffled inlet chamber, allowing solids to fall to the bottom of a main collection chamber as the waste hydrocarbons float upwardly on the water in this chamber. The separated water flows out of the chamber into the sewer system or other discharge areas. When the oil level in the primary vessel reaches a predetermined level, a control system allows water to enter the bottom of the main collection chamber, closes off the normally open water discharge outlet. The entering water forces the waste hydrocarbon level upwardly, until gravity forces the waste hydrocarbons out the waste discharge outlet into a storage vessel. When the waste is completely discharged, normal waste waste flow-through is resumed. Upon filling the storage vessel with waste hydrocarbons, all operations are suspended until the stored hydrocarbons are pumped out.

49015 **Treating aqueous effluents of the petrochemical industry.** Nijst, S.J. *Environ. Sci. Technol.;* **12**: No. 6, 652-656(Jun 1978).

The Petrochemical/Ecology Sector Group of the European Council of Chemical Manufacturers Federations estimated the costs of effluent water treatment for a model petrochemical plant which produces 14 petrochemical products with a total output of 671,000 tons/yr. Costs were estimated for a sewer system, a generalized biological treatment system, filtration of biotreated effluent, and activated carbon adsorption. The annual biological treatment costs for the model petrochemical complex were estimated at about 1% of the proceeds. If an activated carbon treatment system had to be added, the annual costs would rise to 2% of the proceeds. These costs represent 10 to 20% of profit, respectively, at a profit margin of 10% on sales, assuming these costs cannot be passed on to the consumer. The reduction of profit will be more severe for a site that is smaller than the model complex because of economies of scale. Flow diagram, tables, and graphs are included.

POWER CYCLES

49016 (AD-A—061414) **The fluidyne heat engine. Master's thesis.** Mosby, D.C. (Naval Postgraduate School, Monterey, CA (USA)). Sep 1978. 98p. NTIS PC A05/MF A01.

Laboratory tests were conducted on a small scale Fluidyne heat engine in the loaded and unloaded configuration to evaluate the effect of geometric changes on the system's operating characteristics. Liquid column displacements, gas temperature, and pressure were the primary variables measured for various heat inputs and gas volumes. Representative outputs were a pumping rate of 0.0976 gal/min through a head of 0.825 ft, with a overall efficiency of .15%, and operating pressures as high as 5 psig. The results of the experimental program are presented together with a summary of the principles of operation.

BRAYTON

REFER ALSO TO CITATION(S) 48529, 48530, 48531

RANKINE

REFER ALSO TO CITATION(S) 48532

STIRLING

REFER ALSO TO CITATION(S) 48519, 48526

PARTICLE ACCELERATORS

49017 (PUB—300) **Research/accelerators. Bimonthly status report, January—February 1979.** Knight, J.W. (ed.). (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 1979. Contract W-7405-ENG-48. 60p. Dep. NTIS, PC A04/MF A01.

This status report of operations of the Lawrence Berkeley Laboratory includes a section of news items involving LBL personnel, a listing with abstracts of recent publications and presentations by LBL accelerator personnel, a summary of accelerator operations and research programs and a progress report on the PEP storage rings. (GHT)

49018 (UCRL—82712) **Value engineering and the role of R and D in the neutral beam program.** Fink, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 May 1979. Contract W-7405-ENG-48. 7p. (CONF-790473—1). Dep. NTIS, PC A02/MF A01.

From Value engineering workshop, DOE; Germantown, MD, USA (4 Apr 1979).

Value Engineering, simply defined, is a systematic approach to getting more for your money. It has been used to reduce the cost of a wide variety of products by the D.O.D. and in principle, should be applicable to various phases of the Neutral Beam Program. With respect to R and D, the principles of Value Engineering must be used with caution. They are most effective in evaluating directed development with very specific goals, but can be misleading when considering advanced innovative work.

DESIGN, DEVELOPMENT, AND OPERATION

49019 (CONF-781051—, pp 105-113) **Safety in the operation of electrostatic accelerators.** Burn, N. (Atomic Energy of Canada Ltd., Chalk River). Jun 1979.

From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

Safety in the operation of electrostatic accelerators is discussed in terms of analyzing the hazards and devising accident prevention techniques. Some practical guidelines are suggested. The usefulness of making a detailed safety analysis is stressed.

BEAM DYNAMICS, FIELD CALCULATIONS, AND ION OPTICS

REFER ALSO TO CITATION(S) 49069

49020 (ANL-PHY—79-1) **Computer simulation of ion orbits in the Argonne superconducting heavy-ion linac (test version).** Peshkin, M. (Argonne National Lab., IL (USA)). May 1979. Contract W-31-109-ENG-38. 29p. Dep. NTIS, PC A03/MF A01.

The bunch profile is computed in one space dimension, as a function of the available parameters. Transverse motion is neglected.

49021 (BNL—25999) **AGS slow extraction improvements.** Glenn, J.W.; Smith, G.A.; Sandberg, J.N.; Repeta, L.; Weisberg, H. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 6p. (CONF-790327—152). Dep. NTIS, PC A02/MF A01.

From IEEE particle accelerator conference; San Francisco, CA, USA (12 Mar 1979).

Improvement of the straightness of the F5 copper septum increased the AGS slow extraction efficiency from ~ 80% to ~ 90%. Installation of an electrostatic septum at H2O, 24 betatron wavelengths upstream of F5, further improved the extraction efficiency to ~ 97%.

49022 (CONF-781051—, pp 306-315) **Rocket plots of charge state distributions for tandem electrostatic accelerators.** Sayer, R.O. (Oak Ridge National Lab., TN). Jun 1979.

From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

Rocket plots, a new type of display for charge state intensities for tandem accelerators, offer several advantages over previous formats. They are compact, comprehensive, efficient, and facilitate experiment planning and beam preparation. (GHT)

49023 (CONF-781051—, pp 334-356) **Phase measurement and control of bunched beams.** Lewis, R.N. (Argonne National Lab., IL). Jun 1979.

From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

An ion beam buncher has been developed at ANL for bunching all ion species through a tandem accelerator. Bunching to approximately 1 ns is achieved by the system and a superconducting helix further bunches to about 50 ps. These short pulses are to be injected into a superconducting linear accelerator designed to accelerate heavy ions (up to 58) from the tandem to over 6 MeV/nucleon. Transit time variations through the tandem, caused by ripple and fluctuations in the injection and lens power supplies and terminal voltage, and to varying voltage distributions in the accelerating tube, cause a beam-phase variation at the output of the tandem. A beam-phase measurement and control system was designed and installed in conjunction with the ion beam buncher to control beam phase at the tandem output. This system is described.

49024 (CONF-790619—2) **QUARTZ: a numerical simulation of an asymmetric electrostatic accelerator.** Wooten, J.W.; Drooks, L.J.; McCollough, D.H.; McGaffey, R.W.; Whealton, J.H. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 25p. Dep. NTIS, PC A02/MF A01.

From 3. IMACS international symposium on computer methods for partial differential equation; Bethlehem, PA, USA (20 Jun 1979).

The physics and numerical aspects of the development of the computer code QUARTZ are given. This code includes the (1) use of a finite element code to obtain solutions of Poisson's equation in an asymmetric, three-dimensional volume; (2) inclusion of space charge neutralization by electrons; and (3) inclusion of ion space charge through an iterative procedure. (GHT)

49025 (CONF-7706150—P1, pp 297-299) **Stochastic cooling of antiprotons in the little cooling ring.** Rhoades, T. (Univ. of Wisconsin, Madison). 1977.

From Summer study; Aspen, CO, USA (Jun 1977).

The possibility of accumulating antiprotons in the little cooling ring of the Fermilab accelerator using stochastic cooling is discussed. (GHT)

49026 (LA-UR—79-1686) **Simulation of collective ion acceleration in a slow cyclotron beam mode.** Faehl, R.J.; Shanahan, W.R.; Godfrey, B.B. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 15p. (CONF-790723—1). Dep. NTIS, PC A02/MF A01.

From 3. international topical conference on high power electron and ion beam research and technology; Novosibirsk, USSR (3 Jul 1979).

The use of slow cyclotron beam waves is examined as a means of accelerating ions in intense relativistic electron beams. Field magnitudes of between 10^5-and 10^6 V/cm seem achievable in the near term, and while these will never reach the levels of beam front mechanisms, such as virtual cathodes, they will easily exceed conventional ion acceleration sources. (GHT)

49027 (LBL—8385) **Sensitivity of the PEP beam transport line to perturbations.** Peterson, J.M.; Brown, K.L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; Stanford Linear Accelerator Center, CA (USA)). Mar 1979. Contract W-7405-ENG-48. 4p. (SLAC-PUB—2269; CONF-790327—120). Dep. NTIS, PC A02/MF A01.

From IEEE particle accelerator conference; San Francisco, CA, USA (12 Mar 1979).

The sensitivity of a beam-transport line to various perturbations determines the extent to which one can simplify component design and relax tolerances. For the PEP injection lines, effects of various fabrication errors, magnet misalignments, and residual gas scattering were studied. Using the TURTLE ray-tracing program, it is found that magnetic-field errors corresponding to a relative sextupole strength in the dipoles of 0.5% and/or a relative sextupole or octupole strength in the quadrupoles of 5% are permissible. This allows relatively loose tolerances in magnet fabrication. Transverse misalignment of a quadrupole by a distance x causes the beam centroid to be displaced downstream by as much as 5x. This requires a quadrupole alignment accuracy of +- 0.5 mm or better. No compensation for the earth's field is necessary because an integral number of optical wavelengths and a short wavelength were used for the design. Analysis shows that beam broadening from multiple coulomb scattering is insignificant for pressures of less than 1/10 torr.

49028 (SLAC-PUB—2279) **Single wavelength standard wiggler for PEP.** Brunk, W.; Fischer, G.; Spencer, J. (Stanford Linear Accelerator Center, CA (USA)). Mar 1979. Contract EY-76-C-03-0515. 3p. (PEP-NOTE—302; CONF-790327—154). Dep. NTIS, PC A02/MF A01.

From IEEE particle accelerator conference; San Francisco, CA, USA (12 Mar 1979).

A 1λ planar wiggler has been designed that will be used for the initial operation of the 4 to 18 GeV storage ring PEP. Three of these wigglers will be installed symmetrically around the ring at 120° intervals in three of six available 5 m straight sections with the purpose of providing: (1) beam size control to obtain better luminosities below 15 GeV, and (2) decreased damping times to obtain better injection rates at lower energies. Design goals are discussed and a description of the final system including cost estimates is given. Expected results and usage in PEP are discussed. Some possibilities for production of synchrotron radiation and beam monitoring with shorter wavelength, multiple-period wigglers at PEP energies are also discussed. Comparison to a wiggler now operating in SPEAR is given.

49029 (UCID—18210) **Ohmic dissipation during vacuum transport.** Lee, E.P.; Barletta, W.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 22 Jun 1979. Contract W-7405-ENG-48. 13p. Dep. NTIS, PC A02/MF A01.

The energy loss of a highly relativistic beam transported in an evacuated pipe of finite conductivity is calculated.

AUXILIARIES AND COMPONENTS

ION SOURCES

49030 (CONF-781051—, pp 114-136) **Recent ion source development at the University of Pennsylvania.** Middleton, R. (Univ. of Pennsylvania, Philadelphia). Jun 1979.

From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

Development of the Cs^+ beam sputter ion source is reviewed, and performance of recent designs is discussed. (GHT)

49031 (CONF-781051—, pp 137-149) **SNICS: a Source of Negative Ions by Cesium Sputtering.** Billen, J.H.; Richards, H.T. (Univ. of Wisconsin, Madison). Jun 1979.

From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

Recent work on the University of Wisconsin Source of Negative Ions by Cesium Sputtering (SNICS) is presented.

49032 (CONF-781051—, pp 163-166) **Test of usable sputter target size in the Florida State University type inverted sputter ion source.** Billquist, P.J. (Argonne National Lab., IL). Jun 1979.

From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

An attempt to determine the smallest sputter target (cone) size usable to obtain reasonable negative ion beams, from materials difficult to obtain or handle, with the Argonne-built Florida State University type inverted sputter ion source, is reported.

49033 (CONF-781051—, pp 168-186) **Recent negative ion source developments at ORNL.** Alton, G.D. (Oak Ridge National Lab., TN). Jun 1979.

From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

According to specifications written for the 25 MV ORNL tandem accelerator, the ion source used during acceptance testing must be capable of producing a negative ion beam of intensity $\geqq 7.5$ μA within a phase space of $\leqq 1\ \pi$ cm-mrad (MeV)/sup 1/2/. The specifications were written prior to the development of an ion source with such capabilities but fortunately Andersen and Tykesson introduced a source in 1975 which could easily meet the specified requirements. The remarkable beam intensity and quality properties of this source has motivated the development of other sources which utilize sputtering in the presence of a diffuse cesium plasma - some of which will be described in these proceedings. This report describes results of studies associated with the development of a modified Aarhus geometry and an axial geometry source which utilize sputtering in the presence of a diffuse cesium plasma for the production of negative ion beams.

49034 (CONF-781051—, pp 187-222) **ProJuction of negative heavy ion beams through charge exchange processes.** Tykesson, P. (Aarhus Univ., Denmark). Jun 1979.

From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

A review of ion sources in which charge exchange with metal vapor is used is presented. (GHT)

EXPERIMENTAL FACILITIES AND EQUIPMENT

REFER ALSO TO CITATION(S) 49072

49035 (BNL—26114) **Versatile spectrometer for experiments using synchrotron radiation at wavelengths greater than 100 nm.** Sutherland, J.C.; Desmond, E.J.; Takacs, P.Z. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 17p. (CONF-790651—5). Dep. NTIS, PC A02/MF A01.

From National conference on synchrotron radiation instrumentation; Gaithersburg, MD, USA (4 Jun 1979).

The design of the SUPERB spectrometer places great emphasis on flexibility. Optics, electronics and the attendant computer system are of modular design and can be rapidly configured to perform a variety of tasks. This flexibility will permit SUPERB to perform the various experiments described above. Equally important, it should facilitate adaption of SUPERB to perform experiments the nature of which we are presently unaware.

49036 (BNL—26241) **Summary report of the working group on colliding beams, Batavia, Illinois, 15-21 October 1978.** Chen, S.Y.; Courant, E.D.; Keil, E.; King, N.M.; McIntyre, P.; Nishikawa, T.; Vivargent, M. (Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 9p. Dep. NTIS, PC A02/MF A01.

The working group considered the possibilities of p-anti p, p-p and e-p colliding beams associated with a large proton synchrotron. The estimates show that adequate luminosities can be obtained for p-p and p-anti p colliding beams at 20 TeV, even with relatively conservative assumptions about the circulating p and anti p currents. The bunched p-p scheme has a slightly larger luminosity, but the coasting p-p scheme is much simpler and avoids the problem of several events per collision. Colliding e-p beams are also possible with good luminosity for electron energies above 100 GeV.

49037 (BNL—26250) **National synchrotron light source: basic design and project status.** van Steenbergen, A. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 14p. (CONF-790651—3). Dep. NTIS, PC A02/MF A01.

From National conference on synchrotron radiation instrumentation; Gaithersburg, MD, USA (4 Jun 1979).

A summary description and the basic design parameters of the National Synchrotron Light Source, a facility for the generation of intense synchrotron radiation in the VUV and x-ray range is presented, the parameters of the sources are given, the presently planned facility beam lines are tabulated and the status of the project is indicated.

49038 (BNL—26326) **National Synchrotron Light Source.** van Steenbergen, A. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 16p. (CONF-790674—2). Dep. NTIS, PC A02/MF A01.

From Conference on ultrasoft X-ray microscopy; New York, NY, USA (13 Jun 1979).

The National Synchrotron Light Source comprises two high intensity electron storage rings for the generation of intense fluxes of synchrotron radiation in the vuv wavelength domain (700 MeV e^- ring) and in the x-ray wavelength domain (2.5 GeV e^- ring). A description is presented of the basic facility and the characteristics of the synchrotron radiation sources. The present plans for specific beam lines will be enumerated and the planned use of beam wigglers and undulators will be discussed.

49039 (BNL—26368) **Choice of steel for the ISABELLE magnet tubes.** Dew-Hughes, D.; Lee, K.S. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 14p. (CONF-790815—4). Dep. NTIS, PC A02/MF A01.

From Cryogenic engineering conference; Madison, WI, USA (21 Aug 1979).

It is concluded that the low temperature ductility of cast duplex stainless steels can be reduced by high ferrite content, excessive amounts of nitrogen or strong carbide forming elements, and lack of heat treatment particularly at higher ferrite levels. While all samples investigated, with the exception of No. 14 (non-heat treated 12% δ), had mechanical properties more than adequate for the intended service, it was felt advisable to modify the specifications for the tube steels. The requirement is for CF8 as per ASTM specification number A743 with the following modifications: nitrogen content must not exceed 0.08%; niobium content must not exceed 0.1% and total of all carbide formers (Nb, Ti, V, W) must not exceed 0.2%; ferrite content of the casting, as determined from the heat chemistry using the DeLong diagram, must not exceed 10%. A743 already calls for suitable solution heat treatment.

49040 (CONF-781051—) **SNEAP 78: symposium of Northeastern accelerator personnel.** Bair, J.K.; Jones, C.M. (comps.). (Oak Ridge National Lab., TN (USA)). Jun 1979. Contract W-7405-ENG-26. 406p. Dep. NTIS, PC A18/MF A01.

From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

Session topics of the symposium include: tubes, vacuum, and conditioning; gaseous insulation and gas handling systems; charging systems; safety; ion sources; projects recently completed or under construction; stripping; beam transport; control systems; and telemetry. Twenty eight items were included separately in the data base. (GHT)

49041 (CONF-781051—, pp 4-29) **Conditioning and breakdown phenomena in accelerator tubes.** Skorka, S.J. (Univ. of Munich, Germany). Jun 1979.

From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

Important breakdown mechanisms in accelerator tubes are reviewed, and discharge phenomena in NEC tubes are deduced from the surface appearance of the electrodes and insulators of a used tube. Microphotos of these surfaces are shown. (GHT)

49042 (CONF-781051—, pp 30-37) **Conditioning of NEC accelerator tubes.** Yntema, J.L. (Argonne National Lab., IL). Jun 1979.

From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

The conditioning process of NEC tubes was investigated by recording the fluctuations observed with a residual gas analyzer for a fixed mass and a simultaneous recording of the current fluctuations in background pressure. (GHT)

49043 (CONF-781051—, pp 38-49) **Examination of the breakdown properties of pure and mixed accelerator tank gases.** Broadhurst, J.H. (Univ. of Minnesota, Minneapolis). Jun 1979.

From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

An attempt is made to provide a basis for extrapolation of scale tests by introducing the concept of the probability of a spark occurring per unit time under a given set of conditions. If the sparking probability can be determined as a function of electric field strength to which the insulating gas is subjected, then extrapolation can reasonably be made to the probability of a spark occurring in a full size installation. (GHT)

49044 (CONF-781051—, pp 50-65) **Sulfur hexafluoride purification from mixtures with air: a process feasibility study for the Holifield Heavy Ion Research Facility.** Perona, J.J. (Oak Ridge National Lab., TN). Jun 1979.

From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

A preliminary feasibility study was made for the purification of SF_6 vapor contaminated with air for application at the Holifield Heavy Ion Research Facility. Liquefaction appears to be a good way to recover about 90% of the SF_6 if it is badly contaminated (15%

air), and even greater recovery will be possible for mixtures containing less air. Where liquefaction is insufficient alone, adsorption of SF_6 on activated carbon at -50°F looks promising. Two carbon beds each containing about 500 lb of carbon should be sufficient. The refrigeration system for liquefaction and adsorption would have a capacity of about 2 tons. As alternatives, the use of molecular sieves to trap out the air was investigated, but such a bed would require at least 15,000 lb of molecular sieves and very long cycle times. A large-scale desublimer was investigated and appears workable but would require some development work to permit design work to proceed with confidence.

49045 (CONF-781051—, pp 66-71) **Preliminary comparison of MP sparking characteristics for SF_6 insulating gas mixtures and pure SF_6.** Lindgren, R.; Wegner, H.E. (Brookhaven National Lab., Upton, NY). Jun 1979.
From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

A statistical analysis is presented comparing terminal voltage capability of the MP-7 tandem Van de Graaff accelerator with pure SF_6 insulating gas or with a mixture of 50% SF_6, 40% N_2, 6% CO_2 and 4% O_2. (GHT)

49046 (CONF-781051—, pp 72-75) **Separation of air from SF_6 using 13X molecular sieve at room temperature.** Hurley, P.I. (Chalk River Nuclear Lab., Ontario, Canada). Jun 1979.
From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

A system for separation of air from SF_6 using a column loaded with 13X molecular sieve pellets is described. Performance of such a system at Chalk River is described. (GHT)

49047 (CONF-781051—, pp 76-82) **Report on the fourth Tandem Conference at Ebeltoft, June 5—8, 1978.** Chapman, K.R. (Florida State Univ., Tallahassee). Jun 1979.
From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

Highlights from the bi-annual Tandem Conference are given. Performance details of European electrostatic accelerators are given. (GHT)

49048 (CONF-781051—, pp 83-90) **Improvements to the University of Washington FN belt charge and GVM control systems.** Fauska, H. (Univ. of Washington, Seattle). Jun 1979.
From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

A description of the generating voltmeter and terminal belt-charge control systems in use at the University of Washington is presented. Performance of the systems is discussed. (GHT)

49049 (CONF-781051—, pp 91-101) **Refinements to the Brookhaven Pelletron charging system and gradient control.** Thieberger, P. (Brookhaven National Lab., Upton, NY). Jun 1979.
From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

Performance of the Pelletron charging system at Brookhaven is discussed. Measuring methods for determining charge being carried by each run of each chain are described. (GHT)

49050 (CONF-781051—, pp 102-104) **General discussion about chains and resistors.** McKay, J.W. Jun 1979.
From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

A transcript of a discussion centering on charging chains and resistors in electrostatic accelerators is presented. (GHT)

49051 (CONF-781051—, pp 150-162) **^{14}C beam at the Munich MP Tandem.** Kutschera, W. (Univ. Muenchen, Garching, W. Germaany). Jun 1979.
From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

Experiences of operating with a ^{14}C ion beam are reported. Ion source performance, beam transport, and vacuum pumping are discussed. (GHT)

49052 (CONF-781051—, pp 223-253) **Overview of the VICKSI-facility.** Spellmeyer, B. (Hahn-Meitner-Institut fur Kernforschung Berlin GmbH, Germany). Jun 1979.
From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

The accelerator combination VICKSI (Van de Graaff Isochron Cyclotron Kombination fuer Schwere Ionen) is nearly completed after five years of design, construction and assembly. It consists of a converted 6 MV Van de Graaff as an injector and a four sector split pole cyclotron. A general description of the facility is presented.

49053 (CONF-781051—, pp 254-270) **Modification of the Argonne tandem.** Yntema, J.L. (Argonne National Lab., IL). Jun 1979.
From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

The Argonne tandem has been improved as an injector for the superconducting linear post accelerator and is now the determining factor for the quality of data obtainable in nuclear structure experiments with the tandem-linac system. The intensity and stability of heavy ion beams has been substantially improved. The transmission of Ni beams is improved by a factor of 8. As a stand alone tandem, it has now a somewhat lower terminal voltage. However, it is quite likely that with increased operating experience, the terminal voltage will exceed 9 MV.

49054 (CONF-781051—, pp 271-272) **FN tandem project at the University of Ife.** Oso, G. (Univ. of Ife, Nigeria). Jun 1979.
From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

A brief report is presented on the initial steps taken by the University of Ife in Nigeria to set up a tandem Van de Graaff laboratory. (GHT)

49055 (CONF-781051—, pp 273-282) **Buenos Aires tandem accelerator facility.** Filevich, A. (Comision Nacional de Energia Atomica, Buenos Aires, Argentina). Jun 1979.
From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

The intention of the Argentine Atomic Energy Commission to install a large electrostatic accelerator is announced. Plans for a NEC 20UD are discussed and a comparison is made to other possible configurations. (GHT)

49056 (CONF-781051—, pp 283-288) **Operation of the Oxford folded tandem.** Bromley-Barratt, P.J.S.; Brock, T.R.; Doucas, G.; Greenway, T.J.L.; Henwood, A.; Holmes, A.R.; Hyder, H.R.McK.; Parker, G.M.; Takacs, J. (Univ. of Oxford, England). Jun 1979.
From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

The 10 MV vertical single-ended Van de Graaff in the Nuclear Physics Laboratory at Oxford University has been converted to a folded tandem and is now in operation. Preparations for the conversion began four years ago and the accelerator was shut down for the changeover in July 1977. The first beam of $^4He^{3+}$ ions was transmitted through the machine on September 7, 1978. Since then the test program has been devoted to measuring the properties of the transmitted beam and extending the operating voltage and beam current.

49057 (CONF-781051—, pp 290-303) **Operation of a large gridded foil stripper in the terminal of a tandem accelerator.** Chapman, K. (Florida State Univ., Tallahassee). Jun 1979.
From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

A prototype mechanism has been built and installed in the terminal of the F.S.U. S.F.N. tandem accelerator to use a large gridded foil stripper and scan this across the beam. Results are presented from the first two foils used and some observations made about foil preparation and a possible alternative foil mounting grid.

49058 (CONF-781051—, pp 316-332) **Instrumentation and operating procedures for the VICKSI beam line.** Homeyer, H. (Hahn-Meitner-Institut fuer Kernforschung Berlin GmbH, Germany). Jun 1979.
From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

Design specificatons and performance of the VICKSI beam line are summarized. (GHT)

49059 (CONF-781051—, pp 357-371) **Experience with the VICKSI-control-system.** Spellmeyer, B. (Hahn-Meitner-Institut fuer Kernforschung Berlin chemical bondGmbH, Germany). Jun 1979.
From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

The control system of the VICKSI-accelerator facility is based on the following features: standardized hardware which is commercially available; peripheral interfacing standards considering hardware and software aspects; comprehensive operator interface which is easy to use; man—machine communication routed through

the computer; system information held in a central data base; accelerator parameters identified by names; and interpreter for interactive and flexible system use. The present state of the system allows full control and monitoring of the whole accelerator and incorporates about 2000 system variables. In the following a short description of the hardware and software of the control system and of the telemetry system for the Van de Graaff injector is given.

49060 (CONF-781051—, pp 379-385) **Holifield Heavy Ion Research Facility 25-MV tandem accelerator control system.** Ziegler, N.F. (Oak Ridge National Lab., TN). Jun 1979.

From Symposium of northeastern accelerator personnel; Oak Ridge, TN, USA (23 Oct 1978).

An overview of the control system is presented, with discussion of the control procedure. (GHT)

49061 (LBL—8411) **ESCAR, tests of superconducting bending magnets at the accelerator site.** Gilbert, W.S.; Lambertson, G.R.; Meuser, R.B.; Rechen, J.B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1979. Contract W-7405-ENG-48. 7p. (CONF-790327—153). Dep. NTIS, PC A02/MF A01.

From IEEE particle accelerator conference; San Francisco, CA, USA (12 Mar 1979).

ESCAR (Experimental Superconducting Accelerator Ring) was conceived as a project in accelerator technology development which would provide data and experience to insure that planning for larger superconducting synchrotrons would proceed in a knowledgeable and responsible manner. It was to consist of the fabrication and operation of a relatively small proton synchrotron and storage ring with superconducting magnet elements for all of the main ring. The project was funded and design work began in July 1974. During the next two years it became increasingly apparent that the funding rate was directly limiting the rate of completion of ESCAR and that an intermediate goal, a test of the unconventional aspects of the project, was desirable. To that end, twelve dipole bending magnets, one-half of those required for the total ring, were installed at the site along with the 1500 watt helium refrigerator, cryogenic distribution system, electrical power supplies, vacuum systems, and necessary instrumentation. This truncated system was put through an extended series of tests which were completed in June 1978 at which time the ESCAR Project was terminated. ESCAR, and the dipole magnets have been described previously. The results of the systems tests have also been reported. The tests involving the dipole magnets are described.

49062 (ORNL/TM—6889) **Calculated response of a total liquid argon calorimeter to protons and electrons in the 0.5- to 5.0-GeV energy range.** Gabriel, T.A.; Bishop, B.L. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 36p. Dep. NTIS, PC A03/MF A01.

The calculated response of a 50 x 50 x 200 cm^3 total liquid argon calorimeter to protons and electrons in the 0.5- to 5.0-GeV energy range is presented. The device is segmented in alternating x and y planes (50 x 1 x 1 or 1 x 50 x 1 cm^3) so that spatial and angular resolution can be obtained for both coordinates. For 2-GeV incident electrons the calculated values (σ) for the energy resolution and upper limit values for the spatial and angular resolutions are 2.0%, 1.5 cm, and 28 mrad, respectively. Sampling fluctuations is one method used to discriminate between incident electrons and protons. An electron acceptance level of $>$ 95% with $<$ 5% proton contamination is possible at the 2-GeV energy deposition level. The device is also analyzed by treating each of the small sampling sections as flash tubes. As expected, the energy resolution increased but the spatial and angular resolutions remained essentially unchanged.

49063 (SAND—79-0698C) **Design of pulse transformers for PFL charging.** Rohwein, G.J. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 4p. (CONF-790622—24). Dep. NTIS, PC A02/MF A01.

From Pulsed power conference; Lubbock, TX, USA (12 Jun 1979).

Air core pulse transformers powered by low voltage capacitor banks can be simple efficient systems for charging high-voltage (0.5 to 3 MV), pulse forming transmission lines (PFL) such as those used in electron and ion beam accelerators. In these applications pulse transformers must have the combined capability of high voltage endurance and high energy transfer efficiency, particularly in repetitive pulse systems where these features are of primary importance. The design of shielded, high-voltage, spiral, strip transformers which fulfill these requirements is described in this paper. Transformers of this type have been tested in three systems which operate with greater than 90% transfer efficiency and have not failed in over 10^7 shots.

49064 (SAND—79-0718C) **Low prepulse, high power density water dielectric switching.** Johnson, D.L.; VanDevender, J.P.; Martin, T.H. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 3p. (CONF-790622—4). Dep. NTIS, PC A02/MF A01.

From Pulsed power conference; Lubbock, TX, USA (12 Jun 1979).

Portions of document are illegible.

Prepulse voltage suppression has proven difficult in high power, high voltage accelerators employing self-breakdown water dielectric switches. A novel and cost effective water switch has been developed at Sandia Laboratories which reduces prepulse voltage by reducing the capacity across the switch. This prepulse suppression switch causes energy formerly stored in the switch capacity and dissipated in the arc to be useful output energy. The switching technique also allows the pulse forming lines to be stacked in parallel and electrically isolated from the load after the line has been discharged. The switch consists of a ground plane, with several holes, inserted between the switch electrodes. The output line switch electrodes extend through the holes and face electrodes on the pulse forming line (PFL). The capacity between the PFL and the output transmission line is reduced by about 80%. The gap spacing between the output line electrode and the hole in the ground plane is adjusted so that breakdown occurs after the main pulse and provides a crow bar between the load and the source. Performance data from the Proto II, Mite and Ripple test facilities are presented.

49065 (SI AC-PUB—2307) **Aspects of computer control from the human engineering standpoint.** Huang, T.V. (Stanford Linear Accelerator Center, CA (USA)). Mar 1979. Contract DE-AC03-76SF00515. 4p. (CONF-790717—1). Dep. NTIS, PC A02/MF A01.

From 1979 International colloquium on circuits and systems; Taipei, Taiwan (23 Jul 1979).

A Computer Control System includes data acquisition, information display and output control signals. In order to design such a system effectively we must first determine the required operational mode: automatic control (closed loop), computer assisted (open loop), or hybrid control. The choice of operating mode will depend on the nature of the plant, the complexity of the operation, the funds available, and the technical expertise of the operating staff, among many other factors. Once the mode has been selected, consideration must be given to the method (man/machine interface) by which the operator interacts with this system. The human engineering factors are of prime importance to achieving high operating efficiency and very careful attention must be given to this aspect of the work, if full operator acceptance is to be achieved. This paper will discuss these topics and will draw on experience gained in setting up the computer control system in Main Control Center for Stanford University's Accelerator Center (a high energy physics research facility). (In this complex system both open and closed loop computer controls are used, as well as large numbers of manual functions.)

49066 (SLAC-PUB—2340) **First results from Mark II at SPEAR.** Abrams, G.S.; Alam, M.S.; Blocker, C.A. (Stanford Linear Accelerator Center, CA (USA)). May 1979. Contract DE-AC03-76SF00515. 16p. (CONF-790377—1). Dep. NTIS, PC A02/MF A01.

From Highly specialized seminars, probing hadrons with leptons; Sicily, Italy (13 Mar 1979).

First results from the SLAC-LBL Mark II magnetic detector at SPEAR are presented. The performance of the detector is discussed and preliminary results are given on inclusive baryon production R/sub p + anti p/, R/sub Λ + anti Λ/, on decay modes of the D mesons and on two-photon production of eta' mesons.

49067 **Systematics in the control settings of the Berkeley 88 inch cyclotron.** Clark, D.J.; Gough, R.A.; Holley, W.R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.); Jain, A. (Bhabha Atomic Research Centre, Bombay (India). Variable Energy Cyclotron Project). *Nucl. Instrum. Methods;* **154**: No. 1, 1-7(1 Aug 1978).

A modern isochronous cyclotron requires a large number of control settings to produce a wide variety of beams and energies. During fifteen years of operating experience with the Berkeley 88 inch cyclotron a system has been developed for prediction of parameters for new beams. This system substantially reduces the accelerator time required for their implementation. These predictions are based on a combination of computer calculations (from extensive field maps) and simple scaling laws which are derived. The use of model beam solutions is discussed, their range of applicability is specified by equations derived by placing limits on 'acceptable' phase errors. A comprehensive set of operating parameters has evolved which spans the entire operating range of the cyclotron. The concepts discussed in this paper have proven valuable in maintaining the high operational efficiency and versatility of the Berkeley 88 inch cyclotron and should be useful to many other laboratories operating similar facilities.

49068 **Double transmitting Faraday cup: an ion optical control device.** Wells, G.F. (Oak Ridge National Lab., TN (USA)). *Nucl. Instrum. Methods;* **153**: No. 2, 339-341(15 Jul 1978).

A regulating signal related to beam diameter is obtained by proper choice of apertures in a series pair of Faraday cups. The signal controls a focusing lens, preceding the device to maintain

nearly constant beam intensity despite other variables that would defocus the beam.

STORAGE RINGS

49069 (SLAC-PUB—2313) **Distribution function of the weak beam taking the interaction with the strong one into account.** Kheifets, S.A. (Stanford Linear Accelerator Center, CA (USA)). Apr 1979. Contract EY-7ι-C-03-0515. 6p. (PEP-NOTE—298; CONF-790318—3). Dep. NTIS, PC A02/MF A01.

From Symposium on nonlinear dynamics and the beam-beam interaction; Upton, NY, USA (19 Mar 1979).

Developing the idea of fast particle mixing due to a strong nonlinearity of the beam—beam interaction, the distribution function of the weak bunch in the phase space of vertical motion is found. The features of this distribution are discussed and compared to the Gaussian one.

49070 (SLAC-PUB—2320) **Experiments on the beam—beam effect in $e^+ e^-$ storage rings.** Wiedemann, H. (Stanford Linear Accelerator Center, CA (USA)). May 1979. Contract EY-76-C-03-0515. 29p. (PEP-NOTE—299; CONF-790318—5). Dep. NTIS, PC A03/MF A01.

From Symposium on nonlinear dynamics and the beam-beam interaction; Upton, NY, USA (19 Mar 1979).

The maximum luminosity in a positron electron storage ring is fundamentally limited by the beam—beam effect. This is the perturbing effect of the electromagnetic field of one beam on the trajectory of every single particle of the other beam. The electromagnetic field of a charged particle beam is highly nonlinear. At a large distance from the beam center the field falls off like the inverse of the distance. Right in the center of the beam where we have a more or less uniform density distribution over a limited region the field rises linear with the distance from the center. So the field rises from the center of the beam, saturates at some distance and going further out falls off again as 1/r. The amplitude of the field depends on the charge density as well as the aspect ratio of the beam. If the electromagnetic field of one beam gets too large, particles of the other beam get lost which leads to a reduced beam lifetime. This effect has been observed in all electron—positron or electron—electron storage rings built so far and is considered the fundamental limit of the performance of electron—positron storage rings. Over the years many measurements have been performed at various laboratories to find the maximum permissible perturbation and the parametric dependence of that perturbation. In this paper, new measurements performed at SPEAR are presented and compared with measurements from ACO, ADONE, and VEEP-2M. Results from other storage rings have been ignored because they either show lower permissible perturbations or because of insufficient published data.

49071 (SLAC-TN—79-2) **Rf power saving in large storage rings.** Farkas, Z.D. (Stanford Linear Accelerator Center, CA (USA)). 15 May 1979. Contract EY-76-C-03-0515. 22p. Dep. NTIS, PC A02/MF A01.

This note considers the application of CARTOP, constant amplitude rf to pulse converter, to obtain average and peak power gains in large e^{+-} rings. CARTOP is a scheme where energy storage and modulation converts a continuous radio frequency (rf) wave into periodic rf pulses. A system with CARTOP is shown. The modulated rf goes through an energy storing network (ESN) that contains at least one energy storing cavity (ESC), which acts as a flywheel. Between pulses, it takes energy from the klystron and during the pulse it delivers energy to an accelerating cavity (AC).

49072 (BNL—25941) **Solenoid spectrometer magnets.** Baltay, C.; Danby, G.; Mishina, M.; Wanderer, P.; Willis, W. (Columbia Univ., New York (USA); Brookhaven National Lab., Upton, NY (USA); Tokyo Univ. (Japan); European Organization for Nuclear Research, Geneva (Switzerland)). [nd]. Contract EY-76-C-02-0016. 3p. Dep. NTIS, PC A02/MF A01.

Three solenoid detectors are considered for Isabelle. They are characterized by their diameters of 3, 5, and 8 meters. The size of an experimental hall is then considered, taking into account the likely physics goals, detector and return yoke geometries, thickness of superconducting coils, necessary space for detector repair, etc. Comments and major conclusions are presented. (GHT)

INSTRUMENTATION

REFER ALSO TO CITATION(S) 48749

RADIATION INSTRUMENTATION

GENERAL DETECTORS AND MONITORS

REFER ALSO TO CITATION(S) 49164

49073 (LA-UR—79-1571) **High current pulser for experiment No. 225, neutrino electron elastic scattering.** Dalton, C.; Krausse, G.; Sarjeant, J. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 5p. (CONF-790622—13). Dep. NTIS, PC A02/MF A01.

From Pulsed power conference; Lubbock, TX, USA (12 Jun 1979).

With the advent of low-cost honeycomb extrusions of polypropylene sheets, flash chambers have become very attractive for large nuclear particle detector arrays. This has brought about the need for a pulse power system that will provide high peak currents and low levels of spurious radiation. Each module of 10 flash chambers will require a peak current of 70 KA with a rise time (tau/sub r/) of <50 ns, giving a maximum rate of current rise di/dt of 400 KA/μs. The pulser output must develop 7 KV across a load of 0.36 Ω with a pulse width of 500 ns. The repetition rate will be one per second. The paper describes the development of such a system and the impact of the physical limitations of present component technology on lifetime and pulse fidelity.

49074 **Tape transport mechanism.** Groh, E.F.; McDowell, W.; Modjeski, N.S.; Keefe, D.J.; Groer, P. (to Dept. of Energy). US Patent 4,144,454. 13 Mar 1979. Filed date 27 Jan 1977. 8p.

PAT-APPL-763,164.

A device is provided for transporting, in a stepwise manner, tape between a feed reel and takeup reel. An indexer moves across the normal path of the tape displacing it while the tape on the takeup reel side of the indexer is braked. After displacement, the takeup reel takes up the displaced tape while the tape on the feed reel side of the indexer is braked, providing stepwise tape transport in precise intervals determined by the amount of displacement caused by the indexer.

49075 **Mosaic of coded aperture arrays.** Fenimore, E.; Cannon, T.M. (to Dept. of Energy). US Patent Application 942,228. 14 Sep 1978. 11p.

The present invention overcomes the disadvantages and limitations of the prior art by providing a mosaic of aperture arrays. The present invention utilizes either a mosaic aperture or mosaic decoding array to overcome the associated disadvantages and limitations of disengagement and provide a decoded image with zero sidelobes and minimal artifacts. It is therefore an object of the present invention to provide a mosaic of aperture arrays. It is also an object of the present invention to provide a mosaic of uniformly redundant coded aperture arrays. It is also an object of the present invention to provide a mosaic of coded aperture arrays which minimizes detector size. Another object of the present invention is to provide a mosaic of coded aperture arrays which contains complete imaging information within a section of the encoded image having a size the same as the projected shadow of the basic aperture pattern.

RADIATION DOSEMETERS

49076 **Hand and shoe monitor.** Fergus, R.W. (to Dept. of Energy). US Patent Application 942,230. 14 Sep 1978. 13p.

There is provided an improved hand and shoe radiation monitor which utilizes air ionization probes as the detecting medium. The monitor includes a probe support body which includes structural elements which form walls defining a multiplicity of cells. Within each cell is an individual ionization probe. The walls of the cell protect the probes from force applied thereto by the user. The small area of each probe reduces the effect of window vibration on the operation of the device. The output of each ionization probe is coupled together and applied to a fast response time input circuit which distinguishes between unwanted events and the low-level desired events from the hand and shoe.

NUCLEAR SPECTROSCOPIC INSTRUMENTATION

49077 **Use of a large time-compensated scintillation detector in neutron time-of-flight measurements.** Goodman, C.D. (to Dept. of Energy). US Patent Application 945,375. 25 Sep 1978. 12p.

It is the oject of the present invention to provide a scintillation detector which allows the use of a large scintillator without substantially degrading the time resolution when making neutron time-of-flight measurements. The object has been achieved in the present invention by positioning a scintillator which is utilized for neutron time-of-flight measurements at a desired angle with respect to the incoming neutron beam such that the sum of the transit times of neutrons and photons in the scintillator is substantially independent of the position of the scintillation points within the scintillator. This geometrical compensation yields light pulses at the phototube

whose origin times do not depend on the position of the scintillation but whose rise-times do depend on position. Extrapolated zero timing is employed rather than the usual constant fraction timing. As a result, a larger scintillator can be used that increases the data rate and shortens the experiment time. Also, such extrapolated zero-timing achieves timing that is independent of the pulse rise-time and the pulse amplitude.

49078 Low-angle neutron data acquisition system for molecular biology. Schoenborn, B.P.; Alberi, J.; Saxena, A.M.; Fischer, J. (Brookhaven National Lab., Upton, NY). *J. Appl. Crystallogr.;* **11**: 455-460(1978).

The BNL low-angle spectrometer was designed and constructed to accomodate a variety of low- and medium-angle experiments in molecular biology. This spectrometer incorporates a ^{3}He two-dimensional position-sensitive counter. Multilayers or conventional crystals are used as monochromators.

HIGH ENERGY PHYSICS INSTRUMENTATION

49079 (LBL—9350) **Sensitive method for detecting stable fractional charges on matter.** Hirsch, G.; Hagstrom, R.; Hendricks, C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Jun 1979. Contract W-7405-ENG-48. 28p. Dep. NTIS, PC A03/MF A01.

The design of an apparatus which will allow direct detection of stable fractional elementary charges if present on matter at the level of 10^{-24} per nucleon is described in detail. This method depends upon production of a highly uniform and parallel stream of conductive spheres which are charge analyzed by passage through a static electric deflecting field. 6 references.

RADIATION EFFECTS ON INSTRUMENT COMPONENTS, INSTRUMENTS, OR ELECTRONIC SYSTEMS

49080 (AD-A—061116) **Heavy ion radiation effects in VLSI.** Bradford, J.N. (Rome Air Development Center, Griffiss AFB, NY (USA)). May 1978. 23p. NTIS PC A02/MF A01.

Impressive results have been achieved using electron beam, soft x-ray, or synchrotron radiation for lithography and photoresist exposure. Application to microelectronic circuitry paved the way for Very Large Scale Integration (VLSI) in which device sizes of micrometer and submicrometer dimension are forecast. This small size presents new problems for radiation effects test and assessment. One example is the interaction of heavy ions (namely, cosmic rays) with a VLSI size device and the associated nonequilibrium dosimetry involved. This report treats the case of VLSI exposure in satellite environment. The numbers suggest that very small size is not a desirable feature for devices in that environment. (Author)

49081 (AD-A—061309) **Radiation effects on charge-coupled devices and other MOS structures. Final report, May 1977—April 1978.** Srour, J.R.; Othmer, S.; Chen, S.C.; Hartmann, R.A. (Northrop Research and Technology Center, Hawthorne, CA (USA)). Oct 1978. Contracts DAAG39-77-C-0134;MIPR-77-602. 179p. NTIS PC A09/MF A01.

This report describes results of radiation effects studies on charge-coupled devices (CCDs) and other MOS structures. Emphasis is placed on determining the basic mechanisms of the interaction of radiation with such devices with a view toward gaining understanding of benefit to developers of radiation-tolerant devices. A study of neutron damage mechanisms in CCDs was performed with emphasis placed on investigation of dark current increases.

49082 (AD-A—061456) **Effects of EMP testing on semiconductor long term reliability. Final report, 1 April 1976-31 October 1977.** Kahn, S.R. (IIT Research Inst., Chicago, IL (USA)). Nov 1977. Contract DNA001-76-C-0243. 78p. NTIS PC A05/MF A01.

The objective of this research effort has been to determine the long-term reliability effects of pre-stressing semiconductor devices with EMP-like transients. This study was conducted by subjecting large sample lots (approximately 100 per lot) of the JAN 2N918 transistor and the JAN-TX IN914 diode to these electrical transients at a large and a small fraction of the nominal Wunsch damage level for each device. These pre-stressed devices together with an unstressed control lot were then life tested at a junction temperature of 300 C for a continuous 1280 hour period. The effects of EMP prestressing on the reliability of these devices were then assessed by comparing the observed failure rates of the various sample lots under these accelerated life test conditions. (Author)

MISCELLANEOUS INSTRUMENTS

REFER ALSO TO CITATION(S) 48080, 48678, 48797, 49233, 49244, 49313

49083 (CONF-790505—14) **Limitations of thermocouples in temperature measurements.** Anderson, R.L.; Adams, R.K.; Duggins, B.C. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 33p. Dep. NTIS, PC A03/MF A01.

From 25. ISA international instrumentation symposium; Anaheim, CA, USA (7 May 1979).

Factors limiting the accuracy of temperature measurements with type K and type S sheathed thermocouple assemblies are discussed. The effect of short-range ordering in Chromel is shown to limit the accuracy of temperature measurements made with type K thermocouple to about 1%. Errors of as much as 150% have been observed in type K thermocouples in magnetic fields at temperatures below the Curie temperature of Alumel. Both positive and negative errors were observed when the orientations of the applied magnetic field, the temperature gradient and the axis of the Alumel wire were such as to produce an emf along the thermocouple wire due to the Nernst—Ettingshausen effect.

49084 (CONF-790658—4) **Quantitative SIMS analysis of decalibrated Chromel versus Alumel thermocouples using indexed sensitivity factors.** Christie, W.H.; Eby, R.E.; Kollie, T.G. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 2p. Dep. NTIS, PC A02/MF A01.

From 27. annual conference on mass spectrometry and allied topics; Seattle, WA, USA (3 Jun 1979).

Secondary ion mass spectrometry (SIMS) is used to determine the failure mode responsible for the large decalibrations observed in sheathed, MgO-insulated Chromel versus Alumel, compacted thermocouple assemblies, exposed to temperatures above 1100°C. Thermocouples sheathed in Inconel-600 and type 304 stainless steel were studied in this work. Quantified SIMS data showed that the observed decalibrations were due to significant alterations that took place in the Chromel and Alumel thermoelements. The amount of alteration was different for each thermocouple and was influenced by the particular sheath material used in the thermocouple construction.

49085 (SAND—79-0036C) **Development of in situ marine seismic and geotechnical instrumentation systems.** Reece, E.W.; Ryerson, D.E.; Kestly, J.D.; McNeill, R.L. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 14p. (CONF-790833—1). Dep. NTIS, PC A02/MF A01.

From 5. international conference on port and ocean engineering under Arctic conditions; Trondheim, Norway (13 Aug 1979).

A unique pair of in-situ marine geotechnical instrumentation systems, capable of operating unattended for extended periods of time in remote locations, have been designed, fabricated, and are currently undergoing testing. The Seafloor Earthquake Measurement System (SEMS) measures the response of marine sediments to strong and moderate seismic activity. The Geotechnically Instrumented Seafloor Probe (GISP) measures the in-situ pore pressure in soft marine clays. The two systems have many common characteristics. Both systems consist of two principal subsystems: a seafloor data-gathering package and a shipboard command and recording package. The seafloor packages are totally self-contained and incorporate microprocessor-based electronics which control data collection, processing, and storage. Data collected and stored by the seafloor packages are transmitted on command to the command and recording package via a high-data-rate acoustic telemetry system. This paper describes the design, development and testing of the Seafloor Earthquake Measurement System and the Geotechnically Instrumented Seafloor Probe. Data are presented and discussed. Advanced concepts for future marine geotechnical instruments are discussed.

WELL LOGGING INSTRUMENTATION

49086 (LA-UR—79-1180) **Experimental plans for electronic identification field test.** Holm, D.M.; Seawright, G.L.; Araki, C.T.; Nott, S.B.; Sanders, W.M. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 11p. (CONF-790557—1). Dep. NTIS, PC A02/MF A01.

From Livestock conservation institute meeting; Kansas City, MO, USA (7 May 1979).

The first experiments of the electronic identification field test are under way with continuous temperature monitoring equipment. Scientists at the Los Alamos Scientific Laboratory (LASL) have nearly completed a reference identification and temperature monitoring system that will be compared with commercial systems in a field situation. Purchase of commercial equipment has been delayed because of difficulty of manufacturers in meeting the performance

specifications but those problems appear to be near resolution. Organization of the user group is proposed and planning of the first experiments to evaluate the costs and benefits of a National Electronic Identification System.

49087 (SAND—79-0878C) **Logging techniques based on dispersive electrical parameters.** Lysne, P.C. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 13p. (CONF-790805—8). Dep. NTIS, PC A02/MF A01.

From DOE symposium on enhanced oil and gas recovery and improved drillings technology; Tulsa, OK, USA (22 Aug 1979).

Electromagnetic techniques have often been successful for the production evaluation of oil and gas reservoirs. For example, direct current resistivity measurements yield production parameters such as the porosity through ancillary relations like Archie's Law. In another class of measurements, pulsed or sinusoidal electromagnetic fields are introduced into the formation. Then, the measured quantity is the electrical impedance which is dependent upon the dielectric constant and the magnetic permeability as well as the resistivity. Furthermore, these latter three independent electric parameters are often dispersive, that is they are frequency or time dependent. This fact has proven useful in induced polarization logging for sulfide mineralization and nuclear magnetic logging for fluid flow permeabilities. This paper considers the hopes and difficulties associated with the usage of dispersive electrical parameters as production parameter indicators in hydrocarbon reservoirs. The theory of dispersion in linear systems is well developed and is reviewed as it pertains to the constraints imposed on the electrical parameters. The formulation of the ancillary equations relating the electrical and production parameters is not well developed though vestiges of models are present and some of these are discussed.

EXPLOSIONS AND EXPLOSIVES

CHEMICAL

REFER ALSO TO CITATION(S) 49115

49088 (MHSMP—79-32) **Assay of TATB by HPLC, precision and accuracy study.** Schaffer, C.L.; Teter, A.C. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). Jun 1979. Contract EY-76-C-04-0487. 7p. Dep. NTIS, PC A02/MF A01.

The precision and accuracy of a HPLC method for the assay of TATB were determined. The average relative standard deviation (RSD) of the method is 0.57%. Only one TATB sample gave an RSD value greater than 1% and that sample was made by an experimental process using nitrobenzene as the amination solvent rather than toluene. The accuracy error of the analysis averaged 0.62%.

49089 (UCRL—82395) **Status of the LLL tandem-shaped charge designs.** Godfrey, C.S.; Jandrisevits, R.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 22 Feb 1979. Contract W-7405-ENG-48. 18p. (CONF-790376—1). Dep. NTIS, PC A02/MF A01.

From 106. D.E.A.G. meeting; Frankfurt, F.R. Germany (20 Mar 1979).

Lawrence Livermore Laboratory has been engaged in the design of tandem or multistage shaped charges for several years. Analytical and experimental work that focuses on how several aspects of tandem designs affect the jet characteristics is described. The work demonstrates the effectiveness of analytical methodology to specify liner geometries to achieve jets with controlled velocity gradients and high overall efficiency. It also shows that jet clippers and other ancillary components, along with controlled liner thickness, help make clean breaks between the jet and the slug and facilitate insertion of a second jet. Second-stage initiation and interjet time delays are discussed.

49090 (UCRL—82675(Rev.1)) **New TATB plastic-bonded explosive.** Humphrey, J.R.; Rizzo, H.F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). May 1979. Contract W-7405-ENG-48. 20p. (CONF-790578—1). Dep. NTIS, PC A02/MF A01.

From Hazardous materials American Defense Preparedness Association; Albuquerque, NM, USA (15 May 1979).

A binder for use with the remarkably insensitive high explosive TATB that displays enhanced engineering properties for the compacted plastic-bonded explosive (PBX) is described. The binder in the original TATB formulation was Kel-F 800; although this binder may be used to produce high density, mechanically stable billets of TATB that can be machined, repeated thermal cycling between -54 and 74°C causes permanent volume expansion (growth) of 1.5—2.0%. The debonding of binder from explosive that occurs during such growth reduces the mechanical strength of the material. It is shown that TATB also undergoes a secondary mechanical relaxation at about 30°C that coincides with an increase in the coefficient of thermal expansion (CTE) to a higher value than that measured at lower temperatures. The new linear epoxy-type binder essentially eliminates growth, maintains strength after thermal cycling, suppresses the secondary mechanical relaxation, and lowers the CTE between ambient temperature and 74°C by about 25%.

NUCLEAR

49091 (AD-A—061140) **Response of linear elastic transverse-isotropic media to borehole pressuremeter loadings. Final report, 1974-1975.** Baladi, G.Y.; George, M.E. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA)). Sep 1978. 57p. NTIS PC A04/MF A01.

This report documents the development of a closed form solution to the idealized borehole pressuremeter problem in linear elastic transverse isotropic media. The borehole was assumed to be infinitely long and pressurized by a static pressure. The mathematical equations for the distribution of stresses and displacements anywhere around the borehole are derived and incorporated into the computer program BOREHOLE. The solution is relevant to the field determination of constitutive properties for use in ground shock calculations. It shows that, in theory, the pressure versus borehole volume change relations from a series of borehole pressuremeter tests inclined at different angles can be used to deduce an appropriate set of linear elastic transverse-isotropic constitutive properties for a given medium and provide an index to the degree of anisotropy of the material. (Author)

49092 (AD-A—061166) **Postattack impacts of the crisis relocation strategy on transportation systems. Volume I. Analysis and case study. Final report.** Billheimer, J.W.; Fondahl, G.; Simpson, A.W. (Systan, Inc., Los Altos, CA (USA)). Sep 1978. Contract DCPA01-76-C-0317. 151p. NTIS PC A08/MF A01.

This study extends previous research into the transportation implications of a crisis relocation by (1) investigating the effects of a nuclear attack on the reconfigured transportation system and the relocated population, (2) identifying and evaluating alternative means of providing transportation system support to the relocated survivors of such an attack, and (3) reviewing existing relocation guidance in the light of probable postattack consequences. This research evaluates the problem of providing transportation system support following both a relocation effort and a nuclear attack, and systematically proposes and evaluates alternative solutions to this problem. Where applicable, the proposed solutions are examined in detail in a case study of Colorado Springs, Colorado. The study addresses the principal components of the transportation system: vehicles, road and rail networks, and fuel. More than enough vehicles are expected to survive an attack to meet essential transportation needs, although problems of organization and coordination can be anticipated.

49093 (AD-A—061167) **Postattack impacts of the crisis relocation strategy on transportation systems. Volume II. Revised planning guidelines. Final report.** Billheimer, J.W.; Fondahl, G.; Simpson, A.W. (Systan, Inc., Los Altos, CA (USA)). Sep 1978. Contract DCPA01-76-C-0317. 159p. NTIS PC A08/MF A01.

For abstract, see AD-A061 166.

49094 (AD-A—061168) **Postattack impacts of the crisis relocation strategy on transportation systems. Volume III. The role of truckstops in crisis relocation. Final report.** Billheimer, J.W.; Simpson, A.W.; Slibeck, E.J. (Systan, Inc., Los Altos, CA (USA)). Sep 1978. Contract DCPA01-76-C-0317. 118p. NTIS PC A06/MF A01.

In the two decades since they have become a prominent part of the intercity transportation picture, the more than 3,000 truckstops located along the nation's highway system have proven themselves to be an invaluable source of emergency assistance to travelers and commercial truckers in natural disasters. This report investigates the potential role of the nation's truckstop network in an evacuation of U.S. cities in the face of natural disasters or nuclear attack. In addressing the potential role of truckstops in such evacuations, or crisis relocations, a directory of 2,682 primary and secondary truckstops has been assembled. Profiles of typical truckstop activities have been developed, and the role of truckstops in providing relief for travelers during severe winters and hurricane warnings has been chronicled. Nearly 70 percent of the truckstops surveyed in this investigation could be expected to survive a population-based nuclear attack. The relative invulnerability of truckstops to attack, coupled with their importance in the day-to-day movement of intercity cargo, makes them a valuable resource in any crisis relocation plan.

49095 (AD-A—061223) **Improved procedures for determining seismic source depths from depth phase information. Quarterly report, 1 April—30 June 1978.** Page, E.; Houck, R. (Ensco, Inc., Springfield.

VA (USA)). Jul 1978. Contract F08606-77-C-0007. 9p. NTIS PC A02/MF A01.

To compensate for sparse coverage of the AI events by the SRO/ASRO and SDCS networks, the depth determination program has been modified to process seismic array data. This will substantially increase the proportion of AI events that can be processed. A total of 28 events were examined during this quarter; 14 of these could not be processed due to inadequate data. Of the remaining 14 events, depth estimates were obtained on 6 of them, 4 were found to be outside the 10-80 km depth range examined, and 4 are in secondary processing.

49096 (AD-A—061444) **Skin friction drag due to nuclear damage. Final report, February-September 1977.** York, E.; Fleener, W. (Boeing Aerospace Co., Seattle, WA (USA)). 30 Sep 1977. Contract DNA001-77-C-0090. 154p. NTIS PC A08/MF A01.

Typical thin aircraft skin samples were fabricated of aluminum and fiberglass and painted with black enamel and other coatings. The samples were exposed to fluence levels from 20 to 200 cals/sq cm to produce simulated nuclear thermal damage. Their skin friction was then measured at Mach numbers of 0.5 and 0.8 and Reynolds' numbers of 6 to 16 million. An equivalent sand roughness was calculated from the drag. Results showed an initial increase in roughness which then remained constant until the skin melted, debonded or suffered other severe damage.

49097 (AD-A—061464) **Theoretical investigation of loads on buried structures. Volume I. Results of discussion. Final report.** Robinson, R.R. (IIT Research Inst., Chicago, IL (USA)). Aug 1978. Contract F29601-76-C-0124. 234p. NTIS PC A11/MF A01.

The objective of this project was to develop simplified techniques for determining loads on buried structures of cylindrical geometry subjected to severe dynamic airblast load environments. The data forming the basis for these design loads have been primarily derived from numerical, finite element analyses for a wide range of loading, soil, and structural parameters. The numerical results were generated exclusively during this research investigation.

49098 (AD-A—061465) **Theoretical investigation of loads on buried structures. Volume II. Tables and plots. Final report.** Robinson, R.R. (IIT Research Inst., Chicago, IL (USA)). Aug 1978. Contract F29601-76-C-0124. 596p. NTIS PC A25/MF A01.

The objective of this project was to develop simplified techniques for determining loads on buried structures of cylindrical geometry subjected to severe dynamic airblast load environments. The data forming the basis for these design loads have been primarily derived from numerical, finite element analyses for a wide range of loading, soil, and structural parameters. The numerical results were generated exclusively during this research investigation.

49099 (AD-A—061512) **Non-normal impact and penetration. Analysis for hard targets and small angles of attack. Final report.** Bernard, R.S.; Creighton, D.C. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA)). Sep 1978. 83p. NTIS PC A05/MF A01.

A rigid-projectile penetration analysis has been developed for non-normal impact, based on the Cavity Expansion Theory (CET). A modified version of the AVCO penetration code is used to implement the CET analysis, which is intended for hard targets (rock and concrete) and for small angles of attack (less than 10 degrees). Tentative verification has been obtained by comparison with 3-degree reverse ballistic data. More tests are needed for further verification, but the initial results suggest that the CET analysis can be used by projectile designers to estimate internal and external forces and moments. Appendix A describes the basic assumptions and results of the CET. Appendix B presents the results of a dynamic structural analysis. Appendix C compares lateral accelerations obtained using the CET and AVCO formulations of the force distribution.

49100 (NVO—0624-1) **Observed ground motion data from Pahute Mesa events detonated between May 1975 and March 1976.** (Computer Sciences Corp., Falls Church, VA (USA)). Mar 1979. Contract EY-76-C-08-0624. 75p. Dep. NTIS, PC A04/MF A01.

A total of 12 underground nuclear explosions were detonated on the Pahute Mesa portion of the Nevada Test Site between May 1975 and March 1976. As a result of a strong motion instrumentation program deployed by the U.S. Geological Survey, 135 individual seismograms were collected on analog tape at 23 distinct ground locations. The purpose of this data report is to document certain characteristics of the ground velocity recorded in these localities for the U.S. Department of Energy Nevada Operations Office.

EXPLOSION DETECTION

REFER ALSO TO CITATION(S) 49293

49101 (AD-A—061005) **Analysis of explosion generated surface waves in Africa, results from the discrimination experiment and summary of current research. Quarterly report, 1 January—31 March 1978.** Rodi, W.L.; Savino, J.M.; Barker, T.G.; Day, S.M.; Bache, T.C. (Systems, Science and Software, La Jolla, CA (USA)). Apr 1978. Contract F08606-76-C-0041. 101p. NTIS PC A06/MF A01.

Brief summaries of work currently underway or recently completed are given in four study topic areas: Source, Data Analysis, Surface Wave, and Body Wave. The remainder of the report presents research results not previously reported: (1) Discrimination Experiment--Digital short- and long-period body and surface wave data for Eurasian events recorded at a global network of stations are being provided for event discrimination. Efforts have focused on application of the VFM (Variable Frequency Magnitude) discriminant to the short period P waves at four stations; (2) Analytic Continuation of the Elastic Field from a Complex Source in a Halfspace. This section presents the mathematical development of a method for linking finite difference numerical source calculations in a halfspace with analytical techniques for propagating elastic waves in layered media; (3) Theoretical Computation of Lg--This discussion is concerned with the theoretical generation of Lg in a continental earth model. Synthetic seismograms are shown for several ranges and source depths, and (4) Analysis of Surface Waves from the French Test Site in the Sahara.

49102 (AD-A—061006) **Analysis of two decoupled explosion simulations. Topical report.** Bache, T.C.; Masso, J.F. (Systems, Science and Software, La Jolla, CA (USA)). Apr 1978. Contract F08606-76-C-0041. 51p. NTIS PC A04/MF A01.

Two axisymmetric ground motion calculations were carried out by Applied Theory, Incorporated to simulate 25 kt decoupled nuclear explosions in mined cavities in salt. One cavity was spherical with a radius of 66 meters while the other was a 3/1 aspect ratio ellipsoid of revolution. Both had the same volume. Results of the two calculations were analyzed to determine the character of the teleseismic body and surface waves. The spherically symmetric portion of the field is slightly (20-25%) smaller for the spherical cavity. Compared to results of tamped explosions, the decoupling factor for this case is about 140 at one Hertz. The radiation from the ellipsoidal cavity is substantially perturbed from spherical symmetry; the maximum S wave amplitudes are nearly three times as large as maximum P wave amplitudes at 1.0 Hz. However, theoretical body and surface wave seismograms indicate that the M sub B and M sub S values are not substantially different for the two cavities.

ENVIRONMENTAL SCIENCES, ATMOSPHERIC

BASIC STUDIES

REFER ALSO TO CITATION(S) 49127, 49152, 49210

49103 (CONF-770385—) **Carbon dioxide effects: research and assessment program.** Elliott, W.P.; Machta, L. (eds.). (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Air Resources Lab.). May 1979. 127p. Dep. NTIS, PC A07/MF A01.

From Workshop on the global effects of carbon dioxide from fossil fuels; Miami Beach, FL, USA (7 Mar 1977).

Current knowledge of the CO_2 cycle and the consequences of increases in CO_2 content of the atmosphere are discussed. Significant gaps in our understanding are identified and actions to fill these gaps are recommended. Reports on panel discussions on the following topics are presented: atmospheric CO_2, biological effects, ocean geochemistry, and climate effects. Each invited paper has been abstracted and indexed for ERA/EDB. (JGB)

49104 (CONF-770385—, pp 51-62) **CO_2 and the biosphere.** Loomis, R.S. (Univ. of California, Davis). May 1979.

From Workshop on the global effects of carbon dioxide from fossil fuels; Miami Beach, FL, USA (7 Mar 1977).

Two major areas of concern are evident in assessments of the interactions between atmospheric CO_2 and the biosphere. The first of these, the biosphere as a source and sink for gaseous CO_2, involves biosphere pool sizes and transfer processes such as photosynthesis and respiration. The second concerns changes in the character and activity of the biosphere that may result from changes in CO_2 concentration and climate. The principal lines of evidence and argument as presented in the literature are discussed.

49105 (CONF-770385—, pp 63-71) **Carbon dioxide chemistry in ocean water.** Takahashi, T. (Columbia Univ., Palisades, NY). May 1979.

From Workshop on the global effects of carbon dioxide from fossil fuels; Miami Beach, FL, USA (7 Mar 1977).

The Revelle factor, the ratio of the fractional change in p/sub CO_2/ exerted by seawater to that in total CO_2 dissolved in seawater, is an important parameter in the air/sea CO_2 exchange study. In an oceanic alkalinity range of 2.2 to 2.4 meq/kg, it passes a maximum at a total CO_2 value 10 to 20% greater than the mean total CO_2 value of 2.00 millimoles/kg in the surface ocean water. For oceanic alkalinity and total CO_2 range, the Revelle factor increases from 10 to 18 as the p/sub CO_2/ increases from 330 to 900 x 10^{-6} atm. This indicates that the surface ocean water tends to absorb proportionally less CO_2 from the atmosphere until the atmospheric CO_2 concentration is raised to three times the present value. The p/sub CO_2/ data obtained in the Atlantic and Pacific during the GEOSECS expeditions (1972 to 1974) identify the northern North Atlantic as the active sink area for atmospheric CO_2. A comparison of the Atlantic surface water p/sub CO_2/ data obtained during the IGY (1957 to 1958) and the GEOSECS expeditions shows that, during the 15-year period, the surface water p/sub CO_2/ in the Atlantic increased at an average rate of 1.8 (+-0.4) x 10^{-6} atm/year. This rate is comparable to the atmospheric CO_2 increase rate of 1.2 to 1.4 ppM (by volume) per year observed at the Mauna Loa Observatory. It appears the oceanic p/sub CO_2/ increases at a similar rate as the atmospheric CO_2. The box diffusion model of CO_2 distribution in the atmosphere/ocean system yields the observed atmospheric CO_2 increase rate and the Suess effect. It may be used reliably for short-term forecasting of atmospheric CO_2 concentration. However, for a reliable longer-term forecasting method, more oceanographic features, such as regional differences in the vertical eddy diffusivity, the effect of fossil fuel CO_2 neutralization by marine carbonates, particulate carbon flux, and vertical flow velocity should be incorporated into the model.

49106 (CONF-770385—, pp 91-99) **Some considerations of climatic variability in the context of future CO_2 effects on global-scale climate.** Mitchell, J.M. Jr. (National Oceanic and Atmospheric Administration, Silver Spring, MD). May 1979.

From Workshop on the global effects of carbon dioxide from fossil fuels; Miami Beach, FL, USA (7 Mar 1977).

Various aspects of past variations of planetary-scale temperature conditions on the earth that may be helpful in assessing the importance of future temperature changes possibly related to atmospheric CO_2 increases are considered. Discussion is presented under the following section headings: past fluctuations of planetary-scale mean temperature; update of the recent global cooling; changes of climate variability; and a look to the future. (JGB)

49107 (CONF-770385—, pp 100-101) **Effect of increasing the CO_2 concentration on the climate of a general circulation model.** Manabe, S. (Princeton Univ., NJ). May 1979.

From Workshop on the global effects of carbon dioxide from fossil fuels; Miami Beach, FL, USA (7 Mar 1977).

The climatic influence of the change of CO_2 concentration in air is discussed based upon the results from a simplified general circulation model of the atmosphere (Manabe and Wetherald, 1975). The model consists of the equation of motion, thermodynamical equation, equation of radiative transfer, and the prognostic equation of water vapor. The temperature of the earth's surface is determined by the balance condition that no heat is stored there. The depth of snow cover and the amount of soil moisture is determined from the budget of snow and liquid water respectively. One of the main characteristics of the model is the estimation of heat transport by large-scale eddies through explicit computation rather than parameterization. On the other hand, the model contains the following simplifications; a limited computational domain, a idealized topography, no heat transport by ocean currents, and fixed cloudiness.

49108 (CONF-770385—, pp 102-110) **Cryospheric responses to a global temperature increase.** Barry, R.G. (Univ. of Colorado, Boulder). May 1979.

From Workshop on the global effects of carbon dioxide from fossil fuels; Miami Beach, FL, USA (7 Mar 1977).

The term cryosphere embraces all terrestrial manifestations of ice in snow cover, glaciers, ice sheets, seawater and freshwater ice, and ground ice or permafrost. Since snow and ice are persistent only with subzero temperatures, global warming induced by an increase in the atmospheric content of carbon dioxide will lead to changes in the cryosphere. The likely nature and possible magnitude of such effects are reviewed here in the context of existing literature studies. The effects of global warming on snowfall and snow cover, sea ice, permafrost, and ice sheets are considered.

49109 (CONF-770385—, pp 111-118) **Technical fixes for the climatic effects of CO_2.** Dyson, F.J. (Inst. for Advanced Study, Princeton, NJ); Marland, G. May 1979.

From Workshop on the global effects of carbon dioxide from fossil fuels; Miami Beach, FL, USA (7 Mar 1977).

The possibility of disastrous long-term ecological effects caused by an increase in production of CO_2 by fossil-fuel plants is considered. Order-of-magnitude estimates of the feasibility and size of emergency plans that might be proposed are given. Possibilities discussed are the physical transfer of CO_2 to the deep ocean, transfer of CO_2 to the long-term biosphere, biological transfer of CO_2 to the deep ocean, physical extraction of CO_2 from the air, and the balancing of the CO_2-induced heat retention with artificial alteration of the earth's albedo. (JGB)

49110 (JUEL—1558) **Atmospheric cycles of nitrogen oxides and ammonia.** Boettger, A.; Ehhalt, D.H.; Gravenhorst, G. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemie 3). Nov 1978. 164p. (In German). Dep. NTIS (US Sales Only), PC A08/MF A01.

The atmospheric cycles of nitrogenous trace compounds for the Northern and Southern Hemisphere are discussed. Source strengths and destruction rates for the nitrogen oxides: NO, NO_2 and HNO_3 (NO/sub x/), and ammonia (NH_3) are given as a function of latitude over continents and oceans. THe global amounts of NO/sub s/—N and NH_3—N produced annually in the period 1950 to 1975 (34 +- 5 x 10^{12}g NO/sub x/—N/yr and 29 +- 6 x 10^{12} g NH_3—N/yr) are much less than previously assumed. Globally, natural and anthropogenic emissions are of similar magnitude. The NO/sub x/ emission from anthropogenic sources is 1.5 times that from natural processes in the Northern Hemisphere whereas in the Southern Hemisphere it is a factor of 3 or 4 less. More than 80% of atmospheric ammonia seems to be derived from excrements of domestic animals, mainly cattle. Atmospheric NO/sub x/ and NH_3 are removed from the atmosphere mostly by bulk deposition: 24 +- 9 x 10^{12} g NO_3^-—N/yr and 21 +- 9 x 10^{12} g NH_4^+—N/yr. Another fraction may be removed by absorption on vegetation and bare soils and, in the case of ammonia, by oxidation within the atmosphere.

49111 **Plant species on the Department of Energy-Oak Ridge Reservation that are rare, threatened or of special concern.** Parr, P.D.; Taylor, F.G. Jr. (Oak Ridge National Lab., TN). *J. Tenn. Acad. Sci.;* **54**: No. 3, 100-102(Jul 1979).

The need to protect endangered organisms has gained increased awareness during the past decade. These efforts have only recently been expanded to include plants. Lists of candidate species have been compiled for review and status designation by appropriate governmental actions. The Smithsonian report (US Congress 1975) has recommended that the preservation of critical habitats be adopted as a major management practice to ensure the survival of endangered and threatened plant species. In compliance with Federal guidelines, plants, occurring on the US Department of Energy (DOE) Oak Ridge Reservation that are considered rare, threatened or of special concern have been located, identified and provided protection (Oak Ridge Operations 1975). Although only nine candidate species are known to occur on the area, efforts are being made to locate additional species that have been casually observed and reported but not verified by voucher specimens. The purpose of this activity is to summarize present knowledge of the occurrence and distribution of threatened and endangered plant species for long-range management decisions of the DOE-Oak Ridge Reservation.

49112 **Air monitoring milestone: RAPS' [(Regional Air Pollutant Study)] field measurements are in.** Schiermeier, F.A. *Environ. Sci. Technol.;* **12**: No. 6, 644-649, 651(Jun 1978).

A discussion covers the objectives of the RAPS study conducted by the EPA in St. Louis, e.g., to develop, evaluate, and validate air quality simulation models on a regional scale covering urban and rural stationary and mobile sources. The design of the RAPS was discussed including a field measurement program which has been completed, data management, and model evaluation and testing. The Regional Air Monitoring System of the RAPS which consisted of 25 remotely operated, automated stations controlled and polled via telemetry by a central data-acquisition system, data-quality assurance, and the Upper Air Sounding Network were also discussed. Expeditionary investigations, e.g., pollutant transport and dispersion studies, evaluation of instruments, use of helicopters, the exchange of data between RAPS and related studies in the St. Louis area, e.g., the Metropolitan Meteorological Experiment, emission inventories which are now available for the St. Louis area, e.g., for hydrocarbons and sulfur compounds were reported. Data management, and model evaluation and development were also covered. Map, photographs, and table are included.

49113 **Sulfur and crustal reference elements in nonurban aerosols from Squaw Mountain, Colorado.** Lawson, D.R.; Winchester, J.W. (Florida State Univ., Tallahassee). *Environ. Sci. Technol.:* **12**: No. 6, 716-721(Jun 1978).

In order to assess the effect of anthropogenic emissions of sulfur compounds to the atmosphere, sulfur and the crustal reference elements potassium, calcium, titanium, and iron were determined by

proton induced x-ray emission in nonurban aerosols from a remote western US mountaintop before and after snowfall. Sulfur, mainly a submicron aerosol consitiuent, exhibited poor correlation with the crustal group. Crustal element concentrations were markedly suppressed by regional snow cover as well as by falling snow, but suflur concentrations, usually 300 to 400 ng/cu m, were suppressed only when precipitation was occurring. The data suggest that Denver, lying 40 km to the east of the sampling site and at 1600 m elevation, may not have influenced the aerosol levels on Squaw Mountain. Therefore, the aerosol sulfur concentrations may represent regional background levels. Tables, graphs, and 39 references are included.

CHEMICALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 48076, 48097, 48534, 49187, 49281

49114 (ACIRL-PR—77-11) **Oxides of nitrogen and carbon monoxide stack emissions from combustion equipment using N.S.W. and Queensland coals.** Sullivan, K.M. (Australian Coal Industry Research Labs. Ltd., Sydney). Jun 1977. 25p. Australian Coal Industry Research Labs. Ltd., Sydney.

Thirty two coal fired combustion appliances, located in both N.S.W. and Queensland, were tested in order to assess the emissions of CO and NO/sub x/ produced from the burning of various coals in different combustion devices. Carbon monoxide emissions were found to comply in all instances with suggested National Health and Medical Research Council emission standards. However, although oxides of nitrogen emissions from stoker fired industrial plant complied, the tested pulverized coal fired boilers exceeded the suggested limit, but not significantly.

49115 (AD-A—061093) **Boundary conditions for pollution abatement of fast cook-offs and static tests. Technical publication.** Cruise, D.R. (Naval Weapons Center, China Lake, CA (USA)). Oct 1978. 64p. NTIS PC A04/MF A01.

The boundary conditions of military usefulness are considered for the static test of rocket motors and the fast cook-off of ordnance in fuel fires. A boundary may be geometrical, chemical, procedural or administrative in nature and represents a point beyond which the military value of the test is greatly diminished. In the case of administrative boundaries, it is possible that changes can be inititiated at higher levels in the Navy Department. However, if a proposed pollution abatement device violates the other boundaries, the tests may no longer have any military value. (Author)

49116 (AD-A—061295) **Measurement and analysis of airport emissions. Interim report, 1 March 1977—1 July 1978.** Daley, P.S. (Civil and Environmental Engineering Development Office, Tyndall AFB, FL (USA). Detachment 1 (ADTC)). Sep 1978. 21p. NTIS PC A02/MF A01.

This paper is of interest to those involved in regulation and analysis of aircraft related air pollution problems. USAF efforts to measure and model airport pollution are summarized. Efforts include: (1) a joint EPA study at Williams AFB, AZ which involves both modeling and measurement, (2) photographic studies to track plume rise, (3) theoretical model studies to analyze airport pollution. The author concludes that the Williams study, soon to be completed, will greatly aid in determining the accuracy of airport air pollution dispersion models, that air quality modeling studies have shown that state-of-the-art Air Force engines cannot be cost effectively modified to reduce pollution except possibly in the hydrocarbon area and that, at present, unpredictable thermal plume rise of aircraft exhaust renders model ineffective at locations close (<1 km) to the source. (Author)

49117 (BNL—26369) **Modeling sulfur oxide concentrations: an assessment of energy utilization scenarios.** Kleinman, L.I.; Cederwall, R.T.; Meyers, R.E. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 8p. (CONF-790571—2). Dep. NTIS, PC A02/MF A01.

From 6. national conference on energy and the environment; Pittsburgh, PA, USA (21 May 1979).

Sulfate levels in large portions of the eastern U.S. (and elsewhere) have the potential of being strongly affected by emission control regulations as well as by siting and fuel use decisions which will take effect within the next several decades. If ambient standards for sulfate or a surrogate such as fine particulates are promulgated, the relationship of relevant distance scales of atmospheric transport of sulfate to the dimensions of states and air quality control regions must be taken into account. It is the purpose of this paper to document a range of air quality projections which are a consequence of the Department of Energy fuel utilization and emission control scenarios for the year 1990. Levels of sulfur dioxide and sulfate in the contiguous U.S. have been calculated with the BNL AIRSOX long-range transport model using emission inventories consisting of either major fuel-burning sources or major coal-burning sources. The extended spatial scale over which impacts of sulfur oxide emissions are significant is illustrated via an emitter-receptor matrix. This matrix presents the contribution of exposure to SO_4 in each of 10 receptor EPA Federal regions due to SO_2 emissions from each Federal region.

49118 (CONF-770385—, pp 36-43) **Present and future production of CO_2 from fossil fuels: a global appraisal.** Rotty, R.M. (Oak Ridge Associated Univ., TN). May 1979.

From Workshop on the global effects of carbon dioxide from fossil fuels; Miami Beach, FL, USA (7 Mar 1977).

The level of carbon dioxide in the atmosphere is a problem of worldwide proportions. Unilateral action by any one nation in planning alternatives to fossil fuel use will most likely be ineffective in controlling carbon dioxide. Energy growth in the past has been largely based on fossil fuels, and consequently annual carbon dioxide production has increased steadily at a rate of 4.3%. In 1976, global carbon dioxide production contained more than 5 billion metric tons of carbon. Of this, 27% was a result of activity in the United States. By 2025 the total will have grown more than fivefold, and the developing countries and communist Asia will be producing over half the global total. The challenge to the United States is to develop energy supply systems not based on fossil fuels which can and will be used by developing nations.

49119 (CONF-770385—, pp 44-50) **Atmospheric measurements of carbon dioxide.** Machta, L. May 1979.

From Workshop on the global effects of carbon dioxide from fossil fuels; Miami Beach, FL, USA (7 Mar 1977).

Perhaps the most relevant piece of information pertaining to the CO_2 problem is the long record of atmospheric measurements obtained at Mauna Loa, Hawaii. Two types of variations are immediately obvious: first, the upward growth of CO_2 concentration over the 18 years on record; second, the annual cycle displaying a drop during the summer growing season. Evidence for a long-term upward trend of about the same magnitude as determined for Mauna Loa appears in all other records at background stations.

49120 (CONF-770385—, pp 72-90) **Models to predict future atmospheric CO_2 concentrations.** Bacastow, R.B.; Keeling, C.D. (Univ. of California at San Diego, La Jolla). May 1979.

From Workshop on the global effects of carbon dioxide from fossil fuels; Miami Beach, FL, USA (7 Mar 1977).

From current knowledge of the geochemical reservoirs that store and transfer carbon on a global basis, future concentrations of atmospheric CO_2 for various assumed patterns of fossil fuel consumption are predicted. To carry out these predictions, use was made of simple nondimensional chemical tracer reservoir or box models, but comparisons were made with a model in which the ocean is assumed to mix tracers vertically by diffusion.

49121 (EML—356, pp I.251-I.350) **Chemical composition of precipitation and dry atmospheric deposition.** Feely, H.W.; Larsen, R.J. 1 Jul 1979.

In Environmental quarterly, March 1—June 1, 1979.

The effects of changes in patterns of energy use upon the major element and trace element chemical composition of precipitation, dry deposition, and total deposition were studied. Samples of wet, dry, and total deposition are collected on a monthly basis at seven sites within the conterminous United States. The main objective is to gather data on the graphical differences and time trends in precipitation chemistry and in concentrations of pollutants in deposition. These will be related to changing rates of use of various fuels and especially to increasing rates of coal combustion.

49122 (EML—356, pp I.381-I.414) **Determination of ten selected trace metals in precipitation samples using atomic absorption and direct current plasma emission spectrometry.** Sutton, D.C.; Morse, R.S.; Legotte, P.A.; Rosa, W.C. (Dept. of Energy, New York, NY). 1 Jul 1979.

In Environmental quarterly, March 1—June 1, 1979.

Methods of analysis are reported for Al, As, Cd, Cr, Fe, Mn, Ni, Pb, V, and Zn using flameless atomic absorption and sequential dc plasma emission spectrometry in samples of precipitation. The data are compared with independent results from simultaneous multielement inductively coupled plasma emission spectrometry. Good agreement was found for all of the trace metals except arsenic. Various precision levels were required based on the program measurement criteria. For some analyses, the relative percent standard deviation for replicate cadmium measurements at 0.2 ng/ml was 5% using flameless atomic absorption. Precision measurements for dc plasma emission spectrometry ranged from 0.5 to 2% at the 500 ng/ml level to 100% at the 1 ng/ml level. All of our measurements were carried out in a laminar air-flow clean room laboratory without preconcentration of the precipitation samples. Six natural precipitation samples were collected during th summer of 1977; four were from Chester, NT, and two were from New York City. The levels of

metals measured in the Chester, NJ samples decreased as follows: Mn > Fe > Al > Zn > Pb > As > V > Ni > Cd > Cr with a range of 13 to 156 ng/ml and 0.1 to 0.3 ng/ml for the extremes of Mn and Cr, respectively. For the New York samples the levels of metals decreased as follows: Al > Fe > Pb > Zn > Mn > V > Ni > As > Cr > Cd with values of 143 and 297 ng/ml for Al and 0.6 and 1.0 ng/ml for Cd. The average trace metal concentrations, of the two New York City precipitation samples are compared with earlier measurements of trace metals in precipitation samples which were collected from the same site during 1970 to 1976.

49123 (EPA—600/5-79-00/e) **Methods development for assessing air pollution control benefits. Volume V, executive summary.** Brookshire, D.S.; Crocker, T.D.; d'Arge, R.C.; Ben-David, S.; Kneese, A.V.; Schulze, W.D. (Wyoming Univ., Laramie (USA); New Mexico Univ., Albuquerque (USA); University of Southern California, Los Angeles (USA)). Feb 1979. 31p. NTIS, PC A03.

The studies summarized by this volume represent original efforts to construct both a conceptually consistent and empirically verifiable set of methods for assessing environmental quality improvement benefits. While the state-of-the-art does not at present make it possible to provide highly accurate estimates of the benefits of reduced human or plant exposure to air pollutants, these studies nevertheless provide a set of fundamental benchmarks on which further efforts might be built. There are: many benefits traditionally viewed as intangible and therefore non-measurable can, in fact, be measured and be made comparable to economic values as expressed in markets; aesthetic and morbidity effects may dominate the measure of benefits as opposed to previous emphases on mortality health effects; and the likely economic benefits of air quality improvements are perhaps as much as an order of magnitude greater than previous studies had hypothesized.

49124 (IVL-B—418) **Nitrogen oxides in an urban and a rural area.** Grennfelt, P. (Swedish Water and Air Pollution Research Lab., Goeteborg). Jul 1978. 24p. (In Swedish). Dep. NTIS (US Sales Only), PC A02/MF A01.

The nitrogen oxide concentration (NO and NO_2) was studied in Gothenburg during the period September 1974 to December 1977 and at Roervik during the period October 1975 to December 1977. In Gothenburg, the monthly mean values for NO/sub x/ vary between 0.03 and 0.13 ppM. The highest daily mean value is 0.58 ppM and the highest 1-hour mean value 1.41 ppM. For NO_2, the monthly mean values vary between 0.02 and 0.04 ppM; highest daily mean is 0.12 ppM and highest 1-hour mean value is 0.29 ppM. The reason for the high nitrogen oxide concentrations observed is discussed; the major reason is regarded to be automobile traffic. The nitrogen oxide concentrations at Roervik are mostly unaffected by Gothenburg and other local sources. The annual mean values for 1976 and 1977 of NO/sub x/ were 0.0018 and 0.0047 ppM, respectively; of NO_2 0.0090 and 0.0035 ppM, respectively; NO 0.0009 and 0.0011 ppM, respectively. Episodic peak concentrations occur, which may be explained either by long distance transport or contribution from Gothenburg. The highest concentrations observed in connection with long distance transport is 0.073 ppM NO/sub x/. In connection with transport from Gothenburg, concentrations up to 0.13 have been recorded.

49125 (LA—7254-PR, pp 42-47) **Fine particle studies related to health and air cleaning requirements for energy systems.** Tillery, M.I.; Elder, J.C.; Ettinger, H.J.; Fairchild, C.I.; Gonzales, M. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Progress is reported on the following studies: HEPA filter collection efficiency for ultrafine particles; resuspension of particles from surfaces; optimization of filters and stack probe for aerosol stack sampling; and generation of aerosols from oil shale products for inhalation toxicology studies. (HLW)

49126 (LA—7254-PR, pp 79-84) **Terrain influence on low-level meteorological transport.** Barr, S.; Clements, W.E.; Wilson, S.K.; Gedayloo, T.; Archuleta, J. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Studies were conducted on major effects of terrain irregularities on the transport and dispersion of atmospheric effluents. Tracer investigations in a canyon during nocturnal downslope flow and in a daytime cross-canyon airflow were carried out. Progress is reported on the following projects: workshop on research needs for atmospheric transport and diffusion in complex terrain; fluorescent particle tracer experiment; northwest New Mexico boundary layer experiment; multitracer experiment at the Idaho National Engineering Laboratory; and complex terrain airflow model development. (HLW)

49127 (LA—7254-PR, pp 84-85) **Atmospheric methane tracer experiments and modeling for western energy studies (AMTEAM WEST).** Barr, S.; Guthals, P.R. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Tracer experiments are described for assessment of environmental impacts from energy development using methane-21 and methane-20. An experiment conducted at the Savannah River Laboratory showed that the lateral dimensions of the tracer cloud at the 100-km sampling arc corresponded well with the extrapolation of model curves for class A stability. In an experiment at the Idaho National Engineering Laboratory ground-level sampling lines were set up and supplemented by extensive aircraft sampling. A network of surface wind, temperature, and pressure provided continuous data through the valley, and radar-traced constant-density balloons yielded good estimates of trajectories of plume segments. (HLW)

49128 (LA—7254-PR, pp 86) **Transport of toxic solar energy working fluids released to the atmosphere: information requirements.** Barr, S. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

The objective of the current study is to set the framework for estimating hazards due to airborne material released from SHAC facilities. This involves examining the range of system sizes, applications and working fluids, and their chemical and physical behavior in the atmosphere under various meteorological conditions. A series of atmospheric release scenarios are being investigated including leaks, overheating, fire, explosion, and improper disposal. A set of priorities will be established for addressing the scenarios based on extent of the associated hazard and likelihood of occurrence.

49129 (NP—23847) **Generating electricity by burning fossil fuels: the health and safety implications for New York State.** (New York State Legislative Commission on Energy Systems, Albany (USA)). Dec 1977. 68p. NTIS, PC A04/MF A01.

The health and safety implications of generating electricity by burning fossil fuels have been investigated. The findings are: trends in the nation's air quality show that since environmental regulations went into effect in the 1960's there has been a substantial decrease in the ambient levels of most primary pollutants such as TSP, SO_2, and NO/sub x/. Increased burning of fossil fuels, especially coal, will increase the potential for environmental degradation. This impact can be modified at significant energy and economic penalties by technologies such as coal gasification units, fluidized bed boilers, flue gas desulfurization, and electrostatic precipitators. The major short term environmental problem appears to be associated with sulfur and particulate emissions and oxides of nitrogen. These pollutants produce a measurable increase in respiratory ailments. The exact relationships are not known - correlative associations do not inherently show cause-and-effect. High nitrogen oxide and hydrocarbon levels, while they produce effects, are not primarily caused by power plants. Trace metals contained in particulate matter constitute a health hazard. Also, leaches of coal residue ash may produce significant increases in heavy metal concentrations in ground surface waters. This could impact on local ecology and drinking water quality. The precise epidemiological relationship and emissions depend greatly on the coal source. Further evaluation is necessary. Long term problems include acid precipitation and CO_2 pollution. Acid precipitation in particular is a problem facing the wilderness areas of New York State and intensive studies are required and is a particularly difficult problem to solve since the source of the acid is generally outside the state.

49130 (PNL—2964) **Air quality measurements in the coal-fired power plant environment of Colstrip, Montana.** Ludwick, J.D.; Weber, D.B.; Olsen, K.B.; Garcia, S.R. (Pacific Northwest Power Group, Richland, WA (USA)). Jul 1979. Contract EY-76-C-06-1830. 170p. Dep. NTIS, PC A08/MF A01.

A network of up to six air monitoring and sampling stations were operated 4 to 23 km downwind of the 700 MW coal-fired power plants at Colstrip, Montana. Continuous monitoring identified background SO_2 levels in the surrounding air at approximately 1 ppB (2.3 $\mu g/m^3$). Average air concentrations measured in 1978 throughout the network increased to about 2 ppB (4.6 $\mu g/m^3$) as a result of power plant operations. Meteorological and aerosol correlations with SO_2 concentrations helped identify and isolate the major source. The high sensitivity for SO_2 measurement provided resolution of all significant power plant plume fumigations at ground level. The magnitude of SO_2 exposures were higher than predicted in this rough terrain environment.

49131 **Nitrogen dioxide sensing element and method of sensing the presence of nitrogen dioxide.** Colla, J.O.; Thoma, P.E. (to Johnson Controls, Inc.). US Patent 4,142,400. 6 Mar 1979. Filed date 7 Mar 1977. 6p.

An element for sensing the presence of nitrogen dioxide gas in the environment is described. The element comprises a film of a pyrolyzed polyaromatic polymer having semi-conductive properties and mounted on an electrically nonconductive base. Electrical leads are attached at spaced locations to the film and are connected in an electrical circuit with a signalling or control mechanism. The pres-

ence of nitrogen dioxide gas will cause a change in the electrical characteristics of the film to thereby activate the mechanism. A heating element can be associated with the base to insure constant temperature and humidity conditions.

49132 Method of quantifying fugitive emission rates from pollution sources. Milly, G.H. (to Geomet Exploration, Inc.). US Patent 4,135,092. 16 Jan 1979. Filed date 12 Apr 1978. 10p.

A method is described for quantifying fugitive emission rates, such as those emanating from factories, office buildings, and the like. The method is characterized by its ability to quantify airborne fugitive emissions by defining a vertical profile of pollutant flux downwind of pollution sources. The method is thus a major improvement over conventional quasi-stack, roof monitor and upwind-downwind techniques of measuring pollutions. The method is characterized by its ability to quantify fugitive emission rates, regardless of source emission characteristics or topography.

49133 Pollution monitoring apparatus. Lyshkow, N.A. (to Combustion Equipment Associates Inc.). US Patent 4,115,067. 19 Sep 1978. Filed date 25 Feb 1977. 8p.

An apparatus for the detection and/or analysis of pollutant gases is described. It is made up of a light-reflective surface sensitive to a pollutant gas which is capable of reaction with the pollutant gas to cause a decrease in the reflectivity of the surface, a light source means positioned to pass a beam of light angularly onto the surface and a light-sensing means positioned to receive light reflected from the surface. The design also includes a means to contact a gas stream containing the pollutant gas with the surface whereby the decrease in light-reflectivity serves as a measure of the concentration of the pollutant gas in the sample and the rate of decrease in reflectivity serves as a measure of the dose rate of the pollutant gas to which one is subjected.

49134 Seasonal trends in Denver atmospheric lead concentrations. Edwards, H.W.; Wheat, H.G. (Colorado State Univ.,Fort Collins). *Environ. Sci. Technol.;* **12**: No. 6, 687-692(Jun 1978).

During the period January 1972 to June 1975, monthly average atmospheric lead concentrations at five metropolitan Denver sampling sites displayed macima during winter months that coincided with minima in mixing heights. Monthly atmospheric lead inputs estimated on the basis of city-wide consumption of leaded gasoline showed a general downward trend with maxima during summer months. Atmospheric lead concentrations correlated well with the dispersion factor, the product of the mixing height and the mean wind speed. Monthly average atmospheric lead concentrations did not correlate with a simple linear proportion of monthly lead additive consumption, even when effects due to variability in the dispersion factor were statistically removed. Thus, the short-term variability in other parameters, including actual automotive lead emission factors and traffic patterns, masked the variability due to lead additive consumption during the study. However, this does not preclude the possibility that the linear rollback model may still apply to automotive lead over the long term of several years to decades. 32 references, tables.

49135 Air impact. pp II.1-II.65 of Power plant cumulative environmental impact report. Annapolis, MD; Maryland Department of Natural Resources (1978).

Various methods of sulfur oxide emission control have been analyzed for availability and cost. Comparative costs indicate no major difference (for a new plant) between the use of flue gas desulfurization, starting with high sulfur coal, physical coal cleaning, and the use of low-sulfur coal. The use of scrubbers can also generate substantial amounts of waste (for example, 200 tons/h for a 1000 MW plant burning 3.5% sulfur coal using a lime scrubber). The Gaussian plume model, in view of its central role in the prediction of air quality, has been tested using measurements at Maryland power plants. The model has been found to be generally accurate to a factor of two, given flat terrain, low to moderate distance extrapolations, and moderate winds. The limitations on model accuracy in conditions other than these are discussed. The implications of the Clean Air Act Amendments of 1977 upon the siting of power plants are discussed. Because of provisions related to the Prevention of Significant Deterioration (PSD) and non-attainment areas the size and potential locations of new coal-fired power plants may be limited. In particular, the designation of a Class I area in or near Maryland could severely limit the potential for siting a 1000 MW coal-fired plant by creating a 40 to 80 mile exclusion zone surrounding the area. Because of the large area of influence of coal-fired plants, the implications of PSD-related growth limitations will lead to competition for use of the available increments within the State. Similarly, the interstate nature of air pollutant transport may lead to competition and dispute between states.

49136 Sampling and analysis of atmospheric sulfates and related species. Stevens, R.K.; Russwurm, G. *Atmos. Environ.;* **12**: No. 1, 55-68(1978).

From Yugoslovia Academy of Sciences and Arts international sulfur atmospheric symposium; Dubrovnik, Yugoslovia (7 Aug 1977).

Analysis by energy dispersive x ray fluorescence (EDXRF) and by an ion chromotograph (IC) of aerosol samples collected with dichotomous samplers at six locations across the US showed that sulfur in particles less than 3.5 μm dia (fine particles) was in the form of sulfate. Analysis of randomly selected fine particle samples showed the ratio of the sulfate measured by the IC and the sulfur by EDXRF was 2.96:1, in excellent agreement with the value 3.00:1 for pure sulfate. Other randomly selected samples analyzed by the IC showed the sulfite levels were below the detection limit of 8 ng/cu m. Based on these studies, EDXRF methods can now be considered a reliable analytical procedure to measure sulfate (as sulfur) in ambient aerosols. A procedure was developed to preserve the acidity of aerosols collected with an automated dichotomous sampler and was used to sample aerosols in Research Triangle Park, NC. Analysis of the samples showed that sulfate concentrations were 10 to 14 μg/cu m and that the sum of ammonium ion and hydrogen equaled the sulfate concentration expressed in nano-equivalents. Flow diagram, diagram, tables, graphs, chromatogram, and 25 references were included.

49137 Continuous in-situ monitoring of ambient particulate sulfur using flame photometry and thermal analysis. Cobourn, W.G.; Husar, R.B.; Husar, J.D. (Washington Univ., St Louis, MO). *Atmos. Environ.;* **12**: No. 1, 89-98(1978).

From Yugoslovia Academy of Science and Arts international sulfur atmospheric symposium; Dubrovnik, Yugoslovia (7 Aug 1977).

The sulfur component of the St. Louis ambient aerosol was continuously monitored using a flame photometric detector to measure particulate sulfur concentration [Abstract No. 23:31069], and in-situ thermal analysis to chemically analyze the aerosol for H_2SO_4 and its ammonium salts, NH_4HSO_4, $(NH_4)_3H(SO_4)_2$, and $(NH_4)_2SO_4$. During the 16 day monitoring period (4/23 to 5/8/77), the sulfate aerosol varied with respect to chemical composition, but tended to be in the form of the ammonium salts rather than in the form of sulfuric acid. Comparison of particulate sulfur levels with the light-scattering coefficient during the monitoring period indicated that particulate sulfur was a significant constituent of the light-scattering aerosol, but its mass accounted for less than half of the mass of the light-scattering aerosol. Diagram, graphs, and 22 references are included.

RADIOACTIVE MATERIALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 48534, 49280

49138 (EML—356, pp I.3-I.24) **Radioactivity distribution in the stratosphere from the Chinese high yield nuclear test of November 17, 1976.** Telegadas, K. (National Oceanic and Atmospheric Administration, Silver Spring, MD). 1 Jul 1979.

In Environmental quarterly, March 1—June 1, 1979.

China detonated a nuclear device, which was recorted to have a total yield of 4 MT, at 40°N, 90°E on November 17, 1976. Radioactivity concentrations and isotopic ratios in stratospheric air samples up to about 30 km describe the latitudinal and vertical spread of debris from a stratospheric source. An estimate of the initial source distribution for this detonation and the depletion of the resulting stratospheric burden is discussed. Comparisons are made between this event and the five earlier high yield nuclear tests conducted by China, four of which were reported to have a total yield of 3 MT and one a total yield between 2 and 3 MT.

49139 (EML—357) **Radiation measurements following the Three Mile Island reactor accident.** Miller, K.; Gogolak, C.; Boyle, M.; Gulbin, J. (Department of Energy, New York (USA). Environmental Measurements Lab.). May 1979. 20p. Dep. NTIS, PC A02/MF A01.

Following the March 28, 1979 accident at the Three Mile Island Nuclear Power Station, the Environmental Measurements Laboratory deployed several continuous exposure rate monitors and performed field gamma ray spectrometry in the vicinity of the plant. The integrated plume exposures for the period April 2—25 at three locations, between 18 and 25 km from the plant, were less than 0.05 mR. The primary constituent of the plume was found to be ^{133}Xe during this period. The only nuclide deposition observed was from ^{131}I at levels of less than 2 nCi/m^2.

49140 (LA—7254-PR, pp 65-67) **Statistical aspects of the coefficient of variation.** White, G.C.; Hakonson, T.E. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Design of field studies of plutonium is particularly difficult because of the large variability of the data. Conclusive results from an expensive field effort require good estimates of the mean concentration and its variance. Several investigators have noted that the coefficient of variation ($c = \sigma/\mu$) is relatively constant over a wide range of concentration. Therefore, we believe that an efficient approach to the design of a plutonium study is to select a value of c (estimated) from the literature and to combine this estimate with the expected concentration for the field study. Before realistic values of c (est.) are taken from the literature, the researcher should be aware of some of the statistical properties of c (est.). The basic conclusion from this work is that c (est.) is frequently a poorly estimated quantity and that the difficulty increases as c increases. Thus, to design an experiment with a c (est.) based on a small sample will often give unsatisfactory results. A good estimate of c must be used to achieve valid research designs.

49141 (LA—7254-PR, pp 90-92) **Contribution of radon-222 to the atmosphere from inactive uranium mill tailings piles and its attenuation by cover materials.** Marple, M.L.; Clements, W.E. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

The ^{222}Rn flux from tailings piles fluctuates widely during a year, but the average flux is at least 2 orders of magnitude greater than background. Thus, a typical inactive tailings pile with an area of 50 ha and an average flux of 700 atoms cm^{-2} s^{-1} would contribute 6000 Ci of radon to the atmosphere each year. To attenuate the flux by 98%, a cover of 3.9 m of soil would be required. Thus, tailings piles are a significant local source of ^{222}Rn to the atmosphere unless covered by deep overburdens.

49142 (LA—7254-PR, pp 96-100) **Saltation as a transport mechanism of tailings at an inactive uranium mill site.** Marple, M.L.; Barr, S.; Dreesen, D.R. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

The saltation of radioactive tailings particulates from inactive uranium mill tailings piles has been a health concern because some piles are located near residential areas. Little has been done to characterize dust particles blowing from tailings piles, Breslin and Glauberman characterized the radionuclide concentrations in dust at various distances downwind from 3 inactive mill tailings piles. As an extension of this work, a study was initiated to characterize physically and chemically the tailings material transported by particle creep and saltation processes. Information is summarized on the amount, physical size, and alpha radioactivity of particles moved by saltation from 2 inactive tailings piles in the Grants mineral belt of New Mexico.

49143 (NVO—0410-52) **Environmental surveillance report for the Nevada Test Site, January 1978—December 1978.** Lantz, M.W. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)). May 1979. Contract EY-76-C-08-0410. 143p. Dep. NTIS, PC A07/MF A01.

The environmental surveillance program at the Nevada Test Site as conducted by the Department of Energy (DOE) onsite radiological safety contractor from January 1978 through December 1978 is documented. The results and evaluations of measurements of radioactivity in air and water, and of direct gamma radiation exposure rates are presented. Relevancy to DOE concentration guides is established.

49144 **Monitor of the concentration of particles of dense radioactive materials in a stream of air.** Yule, T.J. (to Dept. of Energy). US Patent 4,132,894. 2 Jan 1979. Filed date 4 Apr 1978. 6p.

PAT-APPL 893,234.

A description is given of a monitor of particles of radioactive materials such as plutonium oxide in diameters as small as 1/2 micron. It includes in combination a first stage comprising a plurality of virtual impactors, a second stage comprising a further plurality of virtual impactors, a collector for concentrating particulate material, a radiation detector disposed near the collector to respond to radiation from collected material and means for moving a stream of air, possibly containing particulate contaminants, through the apparatus.

THERMAL EFFLUENTS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 49116

SITE RESOURCE AND USE STUDIES

49145 (ORO—6072-T1) **Characterization and environmental studies of Pompano Beach anaerobic digestion facility. Mid-term report.** Sengupta, S.; Farooq, S.; Gerrish, H.P.; Wong, K.F.; Daly, E.L.; Gabriel, P.; Lascarro, J.F.; Dasgupta, D.; Voorhees, S.; Chriswell, C. (Miami Univ., Coral Gables, FL (USA). Dept. of Mechanical Engineering; Ames Lab., IA (USA)). 1 May 1979. Contract EV-78-S-05-6072. 232p. Dep. NTIS, PC A11/MF A01.

While the major gas constituents have been markedly similar to those in sanitary landfills, the H_2S concentrations have been greater. Vinyl chloride levels have been too low to be of concern. The next effort will be devoted to collecting and analyzing gas samples on a gas chromatographic and hydrogen sulfide analyzer; especially looking for mercaptans and other trace constituents. (PCS)

49146 (PNL—2965) **Estimated airborne release of plutonium from Westinghouse Cheswick site as a result of postulated damage from severe wind and seismic hazard.** Mishima, J.; Schwendiman, L.C.; Ayer, J.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1979. Contract EY-76-C-06-1830. 96p. Dep. NTIS, PC A05/MF A01.

The potential airborne releases of plutonium (source terms) from postulated damage sustained by the Westinghouse Plutonium Fuel Development Laboratories at the Cheswick site in Pennsylvania as a result of various levels of wind and seismic hazard are estimated. The source terms are based on damage scenarios originated by other specialists and range up to 260 mph for wind hazard and in excess of 0.39 g ground acceleration for seismic hazard. The approaches and factors used to estimate the source terms (inventories of dispersible materials at risk, damage levels and ratios, fractional airborne releases of dispersible materials under stress, atmosphere exchange rates, and source term ranges) are discussed. Source term estimates range from less than 10^{-7} g plutonium to greater than 130 g plutonium over a four-day period.

49147 (PNL—3026) **Air quality impacts due to construction of LWR waste management facilities.** (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1977. Contract EY-76-C-06-1830. 66p. Dep. NTIS, PC A04/MF A01.

Air quality impacts of construction activities and induced housing growth as a result of construction activities were evaluated for four possible facilities in the LWR fuel cycle: a fuel reprocessing facility, fuel storage facility, fuel fabrication plant, and a nuclear power plant. Since the fuel reprocessing facility would require the largest labor force, the impacts of construction of that facility were evaluated in detail.

ENVIRONMENTAL SCIENCES, TERRESTRIAL

BASIC STUDIES

REFER ALSO TO CITATION(S) 48055, 49103, 49108, 49109, 49195, 49210

49148 (NVO—0703-1, pp 64-66) **Role of succession in the terrestrial vegetation of an atoll.** Zedler, P.H.; Louda, S. (San Diego State Univ., CA). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

Progress is reported on the following research projects: successional status of each of the more abundant species by observing the number and distribution of individuals by size class; and prediction of the future condition of the vegetation under undisturbed conditions and the response of the vegetation to further disturbance. (HLW)

49149 (TAC-RS—78-003) **Remote sensing of natural resources. A quarterly literature review, July—September 1978.** (New Mexico Univ., Albuquerque (USA). Technology Application Center). Oct 1978. 211p. Univ. of New Mexico, Albuquerque.

All of the documentation included is related to remote sensing sensors or the remote sensing of natural resources. Meteorology and extraterrestrial sensing were not selected. Sensors are primarily those operating with the 10^{-6} to 1 meter wavelength band (ultraviolet through radar). There are exceptions to this when overlapping data is reported, and these have been selected. Recent releases concerning remote sensing include NASA Tech Briefs, ARAC Industrial Applications Reports, U.S. Navy Technical Reports, U.S. Patent Reports, and other technical articles and reports.

49150 **Energy budgets in natural and agricultural ecosystems.** Pimentel, D. (Cornell Univ., Ithaca, NY). pp 299-306 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

Natural ecosystems are discussed with regard to the importance of the food supply in the structure and activities of natural communities and the energy resources collected from the sun. Agricultural ecosystems produce an annual biomass per hectare about double that of natural ecosystems. During the course of evolution humans could not remain hunter-gatherers and turned to slash-burn agriculture; this type of agriculture is the most productive food production technology per energy unit imput. As populations grew, high energy agriculture evolved; the rapid increase in the use of energy in food production in emphasized. The effect of feeding most of the corn and other cereals to livestock on complicating energy accounting is discussed. The effect of the high protein—calorie diet consumed in the United States on energy used in the food system is emphasized. It is estimated that 25% of the world's energy reserve is used for the food system. (HLW)

49151 Energy budget in solar energy conversion in ecological and agricultural systems. Boardman, N.K. (CSIRO, Canberra, Australia). pp 307-318 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

The global annual productivity of photosynthesis equals 3 x 10^{21} J of stored solar energy, which is 10-fold higher than present world consumption of energy. The overall efficiency of solar energy conversion is 0.15%. Maximum short-term growth rates of high yielding crops represent solar energy conversion efficiencies of 2.7 to 4.6%, but annual productivities are considerably lower (0.16 to 1.6%). Forests show average efficiencies of 0.2 to 0.3% in the Northern Hemisphere and even lower ones in Australia. Energy inputs at the agricultural level for non-irrigated crops in Australia are estimated as 7 to 17% of the stored solar energy. Irrigation adds considerably to the energy cost of producing crops. The overall efficiency of fuel production from plant materials ranges from 20 to 58%, with costs which are estimated to be at least 3-fold higher than current prices of fossil fuels. Photosynthesis is unlikely to provide more than a relatively small fraction of the world's energy requirements. In Australia large areas of good agricultural land or productive forest would be required to produce a substantial fraction of that nation's current energy usage.

49152 Recycling of excess carbon dioxide from fossil energy conversion by plants. Wagener, K. (Kernforschungsanlage, Juelich, Ger.). pp 319-328 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

The following topics are discussed: prediction of CO_2 levels in the atmosphere; exchange kinetics between the three major reservoirs of carbon: atmosphere, biosphere, and ocean; response of global primary productivity to rising CO_2 levels; stimulation of photosynthesis by CO_2; effect of higher temperature and rainfall on global primary productivity: consequences on the global standing biomass; and recycling of fossil energy potential by stimulated photosynthesis. (HLW)

CHEMICALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 48119, 48120, 48956, 49103, 49195

49153 (LA—7254-PR, pp 68-71) **Elemental content of saltcedar (Tamarix pentandra) growing in channels receiving effluents from a coal-fired power plant.** Dreesen, D.R.; Wangen, L.E. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

It is possible to classify the elements found in the saltcedar samples into 3 groups according to their behavoir: those elements which are significantly elevated in vegetation from at least one effluent channel and are plant nutrients: molybdenum, boron, copper, manganese, phosphorus, sulfur, magnesium, potassium, and zinc; those elements likely associated with soil and/or coal ash contamination of plant surfaces such as aluminum, silicon, titanium, and perhaps barium and iron; and those elements which are significantly depleted in vegetation from at least one effluent channel: calcium, sodium, and perhaps strontium. Several elements showed elevated concentrations in impacted vegetation compared with control vegetation; however, none of these elements seemed to be present in amounts acutely toxic to the saltcedar or its consumers. Any perturbation in the nutrient pool of ecosystem components can be called an ecological effect. However, this perturbation may not be perceived as being necessarily deleterious.

49154 (LA—7254-PR, pp 72-74) **Potential effects of solar system working fluids as ecosystem contaminants.** Wilson, D.W.; Nyhan, J.W.; Moore, K. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

The field experiment was conducted in August, with soils relatively wet due to rainfall. The ethylene glycol/water mixtures were applied at rates of 1, 25, and 100% ethylene glycol and incrementally measured over 0 to 24, 24 to 48, and 138 to 166 h. Treatment levels of 1 and 25% did not significantly alter the rate of CO_2 evolution in the field. Application of 100% ethylene glycol resulted in cessation of carbon dioxide production, indicating a first-order suppression of microbial activity, perhaps total lethality, to microbial populations. These early pilot experiments suggest that laboratory and field observations are reconcilable--a necessary requirement for the testing system. Current investigations are under way to determine accurately the dose-response function for ethylene glycol and to extend the observations to include recovery rates following applications and the importance of environmental variables, particularly leaching by water.

49155 (LA—7254-PR, pp 92-96) **Selected trace elements and revegetation of uranium mill tailings piles in the Southwest.** Kelley, N.E.; Potter, L.D.; Marple, M.L. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

The potential for trace element toxicity to vegetation has prompted an investigation of trace elements in tailings from other inactive mill sites. Tailings samples were collected from 12 sites in Colorado and Utah and analyzed for extractable arsenic, copper, lead, selenium, and total mercury and radium to evaluate whether or not potentially toxic elements could be found in elevated concentrations in uranium mill tailings piles other than Site C in New Mexico. The results indicate that many of the Colorado and Utah piles have at least 1 of these elements at higher concentrations than Sites A, B, or C and that shallow soil overburdens at these sites contained at least 10 pCi/g of ^{226}Ra. Vegetation samples from the Colorado and Utah piles were collected and are being analyzed at the present time.

49156 Herbicide effects on leaf litter decomposition processes in an oak—hickory forest. Gottschalk, M.R.; Shure, D.J. (Emory Univ., Atlanta, GA). Contract AT-(40-1)-2412. *Ecology;* **60**: No. 1, 143-151(Feb 1979).

Herbicide treatments (2,4,5-Trichlorophenoxyacetic acid) of 0.225 g/m^2 and 2.250 g/m^2 were applied in a Latin square design to the forest floor of an oak—hickory forest in Georgia. White oak (Quercus alba) leaf litter decomposition and litter and soil microarthropod populations were studied in control and treated areas. Weight loss of natural white oak leaf litter averaged 35% for the 1st yr and reached 67% after 2 yr. Litter decomposition rates were similar in control and treated areas. However, white oak leaves defoliated through stem injections lost 59% of their biomass in 1 yr. Decomposition was increased because of initially higher N levels and a lower C:N ratio in defoliated leaf tissue. Herbicide spray treatment increased microarthropod densities for up to 8 mo after application. The herbicide spray apparently influenced springtail and mite reproductive activity in treated areas. The increases in soil and litter microarthropod densities were not sufficient to affect leaf litter weight losses. Repeated defoliation of plant communities and the resulting increased decomposition rates could cause imbalances in litter dynamics and cycling processes. Changes in the timing of annual littefall and the rates of nutrient release may thus lead to soil desiccation and the depletion of available nutrient pools.

RADIOACTIVE MATERIALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 48204, 49139, 49140, 49155, 49272

49157 (DOE/TIC—0037) **Report on residual radioactive materials on public or acquired lands of the United States.** (Department of Energy, Washington, DC (USA). Div. of Environmental Control Technology). 1 Jul 1979. 161p. Dep. NTIS, PC A08/MF A01.

This report identifies sites located on public or acquired lands of the United States containing residual radioactive materials and other radioactive waste (excluding waste resulting from the production of electric energy) and was developed in accordance with the provisions of Section 114(b) of Public Law 95-604, Uranium Mill Tailings Radiation Control Act of 1978, enacted on November 8, 1978. Additionally, the report specifies which Federal agency has jurisdiction over such sites and, where appropriate data were available, Provides a description of the radiological status of each of the sites reported. Based upon the data submitted, the sites were categorized into three broad radiological status categories: controlled, unstabilized, and risk to the public. At controlled sites, the residue is stabilized, access to the site is controlled, the site is well monitored,

and does not currently constitute a risk to the public. At sites in the unstabilized category, a probability exists for the spread of contamination. Sites in the risk category contain residue which represents a long-term risk to the public under present conditions. One the 48 reported sites, 9 (approximately 19%) could be classified in the controlled category; 38 (approximately 79%) were in the unstabilized category and only one was categorized as representing a definite long-term risk.

49158 (LA—7254-PR, pp 60-61) **Comparison of plutonium concentration and inventory ratios for some ecosystem components in the United States.** Hakonson, T.E.; Nyhan, J.W. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Plutonium data from the canyons at Los Alamos and grassland mesas at Trinity Site were compared with data for ecosystem components at the Oak Ridge National Laboratory and Rocky Flats. Tables are presented to show concentration ratios for litter, vegetation, and consumer components of ecosystems at these locations; inventory ratios for soil, litter, vegetation, and consumer components of these ecosystems; and mass and plutonium inventory ratios in canyons at Los Alamos. (HLW)

49159 (LA—7254-PR, pp 63-65) **Comparative distribution of plutonium in Los Alamos and Trinity ecosystems.** Hakonson, T.E.; Nyhan, J.W. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

The distribution and transport of Pu in ecosystem components in the canyon liquid waste-receiving areas at Los Alamos and in the fallout zone of the Trinity atomic bomb test were compared. Tables are presented to show results. Highest concentrations were found in soils. Concentrations of Pu in plants and animals reflected soil Pu contamination. (HLW)

49160 (LA—7254-PR, pp 67-68) **Long-term ecological effects of exposure to uranium.** Hanson, W.C.; Miera, F.R. Jr. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

A third year of study of the ecological consequences of exposure of terrestrial ecosystems at the Los Alamos Scientific Laboratory to elevated soil concentrations of natural and depleted uranium was completed. Specific progress included development of a more accurate and expeditious method of uranium analysis by instrumental epithermal neutron activation analysis; evaluation of inventory estimates, spatial distribution, and particle size correlations of uranium in soils at LASL E-F Site by annuli and isopleth methods; demonstration of different uranium concentration in organs and tissues of deer, mice and pocket gophers from an area of high uranium concentration in soils; evaluation of surface transport of particulate uranium by the processes of surface creep, saltation, and reflotation (suspension); and summarization of results from 2 yr of invertebrate population measurements made by soil core extraction, pitfall trapping, and insect net sweeping at 2 LASL test areas and their controls to evaluate the consequences of exposure to uranium.

49161 (LA—7254-PR, pp 100-102) **Sampling Los Alamos and Trinity site soils for cesium-137.** Nyhan, J.; White, G.; Schofield, T. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

We found that sampling soils for their ^{137}Cs concentration and inventories was a function of site-source factors and volume of soil collected in the field. Mean ^{137}Cs concentrations in Trinity soil were significantly larger in the 12 500-cm^3 samples; this was not the case for sediment samples from Mortandad Canyon (Table I). Furthermore, the 12 500-cm^3 sample size from Mortandad Canyon had a significantly larger aliquoting variation in ^{137}Cs concentrations than the 2500-cm^3 sample sizes, whereas this was not the case for Trinity Site soil samples.

49162 (UCRL—15028) **Recharge and repressurization in the repflo model.** Holland, D.H.; Wilson, R.N. (New Millennium Associates, Santa Barbara, CA (USA)). Jan 1979. Contract W-7405-ENG-26. 16p. Dep. NTIS, PC A02/MF A01.

It is concluded from examination of the REPFLO test problem that recharge and repressurization occupy such short intervals that they are not likely to be important considerations in repository evaluation. Although the test problem was used as an example, it is believed that the conclusions have a considerable range of validity. The analysis made use of several equations from a previous analysis. Only trivial modification is required to permit calculation of recharge times directly from data that are required as input to REPFLO. These times could be added to all output times, so they would constitute only a shift in the origin of the time scale. Should this simple program be implemented, however, a more thorough study of its validity is recommended, and incorporation of flags in the output to warn of violations or questionable validity.

SOIL

REFER ALSO TO CITATION(S) 48233

49163 (DOE/EV/73012—4) **Investigation of the transport of actinide-bearing soil colloids in the soil-aquatic environment.** Sheppard, J.C.; Campbell, M.; Kittrick, J.; Cheng, T. (Washington State Univ., Pullman (USA)). Nov 1978. Contract EY-76-C-06-2221-012. 28p. (RLO—2221-T-12-4). Dep. NTIS, PC A03/MF A01.

Research indicated that organic and inorganic particles strongly influence the distribution ratios of Am(III), Np(V), and Cm(III). Gel Permeation chromatography experiments indicate that distribution ratios are stongly dependent on the concentration of particles having molecular weights of approximately 50,000. These molecules or particles are probably polymers of humic acid. Particle-size dependent distribution ratios have been obtained for the Ritzville, Burbank, and Fuquay soils. Equations are derived to demonstrate the relationship between humic acid complexes and distribution ratios.

49164 (LA—7750) **Studies of long-term ecological effects of exposure to uranium IV.** White, G.C.; Gladney, E.S.; Bostick, K.V.; Hanson, W.C. (Los Alamos Scientific Lab., NM (USA)). May 1979. Contract W-7405-ENG-36. 20p. (AFATL-TR—79-9). Dep. NTIS, PC A02/MF A01.

Research performed by the Los Alamos Scientific Laboratory for the Air Force Armament Laboratory, Eglin Air Force Base, Florida, is reported. The phoswich portable survey instrument was evaluated as a uranium field-survey instrument and seems to be useful for double sampling as well as for the quick field surveys for which it was originally designed. Three methods used to measure uranium concentrations in soils were also compared. Eglin personnel have determined approximate concentrations by analyzing soils in an ND-100 gamma counter. Thermal-neutron-induced delayed neutron activation and instrumental epithermal neutron activation analysis are the methods used at the Los Alamos Scientific Laboratory. Comparison of the three analytical techniques indicates differences; only part of the lack of agreement is explainable by the heterogeneity of aliquots taken from the same soil sample. There seems to be a basic difference in what each of the three techniques measures.

TERRESTRIAL ECOSYSTEMS AND FOOD CHAINS

49165 (EML—356, pp I.47-I.58) **World wide distribution of radium-226 in ashed human bone.** Fisenne, I.M.; Keller, H.W. 1 Jul 1979.

In Environmental quarterly, March 1—June 1, 1979.

Samples of ashed human bone from 5 continents and 2 island areas were analyzed for ^{226}Ra. These data and additional measurements by other investigators show that the concentration of ^{226}Ra in human bone ash ranges from 3 to 36 fCi per gram of ash.

49166 (NUREG/CR—0758) **Contamination of the human food chain by uranium mill tailings piles.** Holtzman, R.B.; Urnezis, P.W.; Padova, A.; Bobula, C.M. III. (Argonne National Lab., IL (USA)). Mar 1979. Contract W-31-109-ENG-38. 55p. (ANL/ES—69). Dep. NTIS, PC A04/MF A01.

A study is in progress to estimate the contamination of the human food chain by uranium, ^{230}Th, ^{226}Ra ^{210}Pb, and ^{210}Po originating from tailing piles associated with uranium ore processing mills. Rabbits, cattle, vegetables, and grass were collected on or near two uranium mill sites. For controls, similar samples were obtained from areas 20 km or more from the mining and mill operations. For the onsite rabbits the mean ^{226}Ra concentrations in muscle, lung, and kidney of 5.5, 14, and 15 pCi/kg wet, respectively, were substantially higher than those in the respective tissues of control animals (0.4, 1.5, and 0.2 pCi/kg). The levels in liver did not differ significantly between the groups. The concentrations in bone (femur and vertebra) were about 9000 and 350 pCi/kg ash for the onsite and offsite animals, respectively. The levels of ^{210}Pb and ^{210}Po did not differ significantly for a given tissue between the two groups, except that the ^{210}Pb level in the kidney was greater in the onsite group. For cattle, the concentrations in muscle, liver, and kidney do not differ greatly between those grazed near the pile and the controls. The levels of ^{226}Ra, and possibly of ^{210}Pb, appear to be greater in the femur of the animals near the piles. Vegetables from a residential area on a mill site contained substantially greater concentrations of ^{226}Ra and ^{210}Pb than those reported for standard New York City diets. Grass and cattle dung from land irrigated by water containing 60 pCi/L ^{226}Ra from uranium mines had concentrations of ^{226}Ra and ^{210}Pb 50 and 8 times, respectively, those in control samples. It is estimated that doubling the normal concentrations in meat and vegetables of uranium and daughter products could increase the dose equivalent rates to the skeletons of persons consuming these foods by 30 or more mrem/yr.

49167 (PNL—2984) **Environmental consequences of postulated plutonium releases from Westinghouse PFDL, Cheswick, Pennsylva-**

nia, as a result of severe natural phenomena. McPherson, R.B.; Watson, E.C. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1979. Contract EY-76-C-06-1830. 63p. Dep. NTIS, PC A04/MF A01.

Potential environmental consequences in terms of radiation dose to people are presented for postulated accidents due to earthquakes, tornadoes, high straight-line winds, and floods. Maximum plutonium deposition values are given for significant locations around the site. All important potential exposure pathways are examined. The most likely calculated 50-year collective committed dose equivalents are all much lower than the collective dose equivalent expected from 50 years of exposure to natural background radiation and medical x-rays except Earthquake No. 4 and the 260-mph tornado. The most likely maximum residual plutonium contamination estimated to be deposited offsite following Earthquake No. 4, and the 200-mph and 260-mph tornadoes are above the Environmental Protection Agency's (EPA) proposed guideline for plutonium in the general environment of 0.2 $\mu Ci/m^2$. The deposition values following the other severe natural phenomena are below the EPA proposed guideline.

49168 (JPRS—73135, pp 33-37) **Strontium-90 as a factor in environmental pollution.** Ternov, V.I.; Vinogradov, M.A.; Gurskaya, N.V.; Fedoseeva, N.A. 2 Apr 1979. Translated from Zdravookhr. Beloruss.; No. 1, 35-37(1979).

In Translations on USSR science and technology: Biomedical and Behavioral Sciences, No. 60.

Fallout of strontium 90 was monitored by accumulation in the food chain associated with intake of the nuclide by man for the purpose of establishing safe exposure levels in conjunction with background radiation. (PCS)

SITE RESOURCE AND USE STUDIES

REFER ALSO TO CITATION(S) 48054, 48075

49169 (LA—7624-T) **Vegetational stabilization of uranium spoil areas, grants, New Mexico.** Kelley, N.E. (Los Alamos Scientific Lab., NM (USA)). Jan 1979. Contract W-7405-ENG-36. 96p. Dep. NTIS, PC A05/MF A01.

Thesis. Submitted to Univ. of New Mexico, Albuquerque.

Factors that could be detrimental to vegetative stabilization of uranium mine and mill waste material were examined. Physical and chemical analyses of materials from an open-pit uranium mine and material from three inactive mill tailing piles in New Mexico were performed. Analyses for selected trace elements in mill tailing material and associated vegetation from piles in New Mexico, Colorado, and Utah were also performed. Field and laboratory experiments identified problems associated with establishing vegetation on spoil material. Problems of uptake and concentration of toxic elements by plants growing on specific spoil material were also identified. Ecological observations in conjunction with physical and chemical analyses of specific geologic units, which form the overburden and waste dumps at the open-pit mine, identified a specific geologic material that, if segregated and placed on the surface of the dumps, would pose the least set of problems for a revegetation program. A pilot revegetation project verified that segregation and use of specific geologic material in the overburden could be utilized successfully and economically for reestablishment of native vegetation on mine waste material.

49170 (ORNL/TM—6814) **Land-use conflicts with natural vegetation in the United States.** Klopatek, J.M.; Olson, R.J.; Emerson, C.J.; Joness, J.L. (Oak Ridge National Lab., TN (USA)). Jun 1979. Contract W-7405-ENG-26. 29p. Dep. NTIS, PC A03/MF A01.

The potential existing vegetation cover of the United States was determined, using a computer algorithm developed to subtract Conservation Needs Inventory land-use data from Kuechler's Potential Natural Vegetation of the United States. This was done on a county-by-county basis for the 48 conterminous states. The results indicate that 23 of the 106 vegetation types have each been reduced by over 50% by man-induced land uses. In contrast, only 26 types have had 5% or less of their potential area converted to urban, agricultural, pasture, or other miscellaneous uses. Tule marshes showed the greatest destruction, losing 88% of their original area, primarily to agriculture. Bluestem prairie and its transition zone with oak-hickory forest declined by 85% and 77%, respectively, primarily due to agriculture. Over 41 x 106 ha of these two vegetation types have been converted to other uses. The agricultural states of Iowa, Illinois, and Indiana have the least amount of land covered by natural vegetation - 8, 11, and 18%, respectively. Despite the drawbacks of using Kuechler's Potential Natural vegetation of the United States and CNI land-use data, the results give a fairly accurate and startling portrayal of the area occupied by natural vegetation.

REGULATIONS

REFER ALSO TO CITATION(S) 48770, 49157

ENVIRONMENTAL SCIENCES, AQUATIC

BASIC STUDIES

REFER ALSO TO CITATION(S) 49103, 49104, 49105, 49108, 49109, 49197, 49198, 49200, 49201, 49207, 49241

49171 (NVO—0703-1) **Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.** Reese, E.S.; Johnson, V.R. Jr. (Hawaii Univ., Honolulu (USA). Office of Research Administration). Feb 1979. Contract EY-76-C-08-0703. 68p. Dep. NTIS, PC A04/MF A01.

Separate abstracts were prepared for 18 papers of the report. (HLW)

49172 (NVO—0703-1, pp 10-11) **Relative abundance of resident versus oceanic zooplankton over an interisland reef.** Alldredge, A.L.; King, J.M. (Univ of California, Santa Barbara). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

Zooplankton were collected from various substrate types. Densities were determined and results indicated that demersal plankton were abundant on the Japtan reef flat. Behavioral mechanisms were exhibited by many organisms including swimming near the substrate or in the lees of coral heads. Demersal plankton may provide an important food source for nocturnally foraging fishes. (HLW)

49173 (NVO—0703-1, pp 24-27) **Population studies of echinoderms and growth and mortality of sea cucumbers.** Ebert, T.A. (San Diego State Univ., CA). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

Progress is reported on the following studies: methods of collecting sea cucumbers; determination of growth rates of plates of the calcareous ring; use of growth parameters and a length-frequency distribution to estimate mortality and population turnover; movement of materials through the atoll ecosystem; and autoradiographic studies on spines of sea urchins. (HLW)

49174 (NVO—0703-1, pp 28-29) **Study of the agents and dynamics of coral bioerosion.** Highsmith, R.; Riggs, A. (Univ. of Washington, Seattle). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

Roles of various burrowing organisms in altering and generating infaunal habitat structure and in excavation and destruction of corals were studied. Burrowers and associated organisms were collected from corals and included polychaetes, sponges, bivalves, gastropods, sipunculans, crustaceans, echinoids, and nematodes. Sections of microatolls were analyzed for growth rates and sponge burrowing rates. Corals with a basal diameter of less than 6 cm suffered greater mortality due to bioerosion than larger heads. (HLW)

49175 (NVO—0703-1, pp 34) **Reef coral taxonomy workshop at the Mid-Pacific Marine Laboratory, Enewetak Atoll.** Lang, J.C. (Univ. of Texas, Austin). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

About 2,500 specimens of coral from 28 different sites around Enewetak Atoll were collected, labelled, cleaned and divided among approximately 170 species of scleractinians and about 5 species of non-scleractinian corals. A complete collection of the best specimens was given to the MPML; and another complete collection was deposited in the Bishop Museum. Remaining replicates were given to the USNM (Washington), the Rijksmuseum van Natuurlijke Historie (Leiden), and the British Museum (London). Fairly detailed habitat and living appearance records were made for most specimens, and some were photographed underwater. Some of the specimens in the MPML and BPBM collections are being photographed to show skeletal characteristics. This collection and data are currently forming the basis of the Enewetak reef coral guide (Lang et al., manuscript in prep.). The specific information recorded for the specimens will be transferred to tape and stored in the Hawaii Coastal Zone Data Bank. After publication of the guide, all original B & W photographic negatives and color transparencies will be deposited in the Bishop Museum.

49176 (NVO—1253-16) **Tables of the leaky aquifer well function.** Case, C.M.; Ghiglieri, D.L.; Fallon, K. (Nevada Univ., Reno (USA). Desert Research Inst.). May 1979. Contract EY-76-C-08-1253. 38p. Dep. NTIS, PC A03/MF A01.

Tables of the leaky aquifer well function have been calculated using an adaptation of an expansion in terms of exponential integrals. These are calculated to higher precision and extended ranges of the usual lumped parameter independent variables than previously existing tables. The series representation used in the computations converges absolutely and appears not to have been previously noted in the literature.

49177 **Studies on the Tintinnida of Enewetak Atoll.** Gold, K.; Morales, E.A. (New York Aquarium, Brooklyn). *J. Protozool.;* **24**: No. 4, 580-587(1977).

Twenty-six species of Tintinnida were identified in the plankton at Enewetak Atoll. The majority of species in this habitat had hyaline loricae. The agglutinated forms had a high degree of specificity for the types of calcium-containing particles that they incorporated into the loricae. Scanning electron micrographs of loricae are presented for 10 species.

49178 **Proceedings of conference on water requirements for lower Colorado River Basin energy needs.** Phoenix, AZ; Arizona State Fuel and Energy Office (1975). 344p. Office of Arid Lands Studies, Tucson, AZ 85719 $10.00.

From Conference on water requirements for lower Colorado River Basin energy needs; Tucson, AZ, USA (8 May 1975).

The conference was designed to provide the latest technical data on the management of water and energy needed to produce new energy sources in the lower Colorado River Basin and relate this to the cost of maintaining the present environment. Of particular interest at the conference was the realization that it takes energy, as well as water, to extract energy. Therefore, the papers delivered assessing new energy technology - oil shale, coal gasification, geothermal, and solar - accounted for both requirements.

CHEMICALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 48118, 48119, 48120, 48121, 48122, 48534, 49014, 49015, 49153, 49281

49179 (AD-A—061225) **Morphological analysis of underwater sensing for Coast Guard applications. Final report, July 1977—January 1978.** Malme, C.I.; McElroy, P.T.; Stern, R. (Bolt, Beranek, and Newman, Inc., Cambridge, MA (USA)). Apr 1978. Contract DOT-CG-71395-A. 176p. NTIS PC A09/MF A01.

The purpose of this study was to survey and explore concepts of underwater and water-related sensing systems and determine the technology appropriate for present and anticipated Coast Guard activities. The procedure employed both a literature study and a survey letter to sensor manufacturers and users to obtain a broad base of representative sensor information. The information was cataloged in a computer file using a classification system which included sensor, environment, and object descriptor groups. Selected Coast Guard activities were considered in detail to determine their general sensor requirements. A computer-aided morphological method was used to analyze the required general sensor operating characteristics and concurrently examine the data base to determine the relevance of existing technology. General recommendations were developed for the application of existing technology and for the development of new technology where indicated. (Author)

49180 (CONF-790726—1) **Simulation in the service of environmental research: experience with a stream ecosystem project.** O'Neill, R.V.; Emanuel, W.R.; Newbold, J.D.; Elwood, J.W. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 17p. Dep. NTIS, PC A02/MF A01.

From Summer computer simulation conference; Toronto, Ontario, Canada (Jul 1979).

A perspective on the use of simulation modeling as one working component of a complex ecosystem research project is presented. Experiences with modeling in the context of a research program dealing with nutrient dynamics in stream ecosystems are documented. As the project progressed, the role of modeling changed, resulting in four distinct models, each developed for a specific purpose. The models have been used to screen initial hypotheses, set up details of the experimental design, analyze results, and serve as a logical framework for investigating mechanistic details of the ecosystem. Through time, individual models were discarded, not because they were inadequate, but because they were irrelevant to the next stage of the project. It was particularly interesting to note how the importance of validation, as well as its characteristics, have changed during this process.

49181 (DOE/EV/70029—4) **Mesoscale studies of flow regimes and fluxes of particulate matter in coastal waters. Annual progress report, 1 April 1978—31 March 1979.** Pak, H.; Small, L.F.; Zaneveld, J.R.V.; Nelson, D.M. (Oregon State Univ., Corvallis (USA). School of Oceanography). Feb 1979. Contract EY-76-S-06-2227-029. 29p. (RLO—2227/T29-4). Dep. NTIS, PC A03/MF A01.

Progress is reported on the following research projects: winter effects on patterns of total suspended particulate matter and of phytoplankton; development of a numerical model of time-space distribution of suspended particulate matter in the near-coast region; development and testing of in situ underwater instruments; and identification of spatial and temporal patterns of biogenic and non-biogenic particles, and healthy and non-healthy biogenic fractions for more rational placement of near-coast structures and identification of productive and non-productive zones. (HLW)

49182 (EML—356, pp I.415-I.428) **Application of dc argon—plasma echelle optical emission spctrometry to the determination of trace metals, especially lead, in estuarine and marine waters.** Cox, W.G. (Naval Underwater Systems Center, Newport, RI); Cox, G.V. 1 Jul 1979.

In Environmental quarterly, March 1—June 1, 1979.

Dc argon—plasma echelle optical emission spectrometry provides a rapid, accurate, and direct means of determining trace metals without first preconcentrating them. It has been found that neither CHELEX-100, APDc, nor Metro-Discs can extract lead and certain other metals with acceptable efficiency, unless sequestering organics and other interferants have first been destroyed. The dc plasma source creates an environment hot enough to decompose all refractory metal complexes, and thereby nullify their effect, as determinations are being done. The possibility is raised that previous analyses of estuarine and coastal marine waters by extraction and/or atomic absorption methods might have yielded falsely low concentrations for sequestered metals, because the extraction techniques used in their determination were less efficient than assumed, and because, therefore, the analytical methods employed were not quantitative.

49183 (EML—356, pp I.429-I.462) **Matrix effects in the determination of trace elements in sea water by dc plasma emission spectrometry (PES).** Gilbert, T.R. (New England Aquarium, Boston, MA). 1 Jul 1979.

In Environmental quarterly, March 1—June 1, 1979.

A description is given of a study of matrix effects in the dc plasma emission spectrometric determination of trace concentrations of Al, Cr, Cu, Fe, Mn, Ni, P, Si, V, and Zn in seawater. To investigate the effects of varying salinity upon sensitivity and background intensity at pre-selected analytical wavelengths, a concentrated sea salt solution was prepared by evaporating a sample of Boston Harbor water (salinity = 32‰ to about a quarter of its original volume. Aliquots of this concentrate were diluted with natural seawater, and with deionized distilled water, to produce solutions having salinities ranging from 0 to 100‰. Both photoelectric spectral scanning and photography were used to perform a detailed study of shifts in background intensity. In nearly every case, the presence of sea salt increased both analytical sensitivity and background intensity. These augmentations in sensitivity are not attributed to any single simple cause, although several possibilities are discussed. Increases in background intensity are found to be caused primarily by intraorder optical smearing, and secondarily by inter-order stray-light effects.

49184 (EML—356, pp I.463-I.478) **Hazardous chemical and oil spill analysis by dc plasma emission spectroscopy.** Eastwood, D. (Coast Guard Research and Development Center, Groton, CT); Hendrick, M.S.; Callaway, S.; Cox, W.G. 1 Jul 1979.

In Environmental quarterly, March 1—June 1, 1979.

Dc plasma emission spectroscopy was used to analyze environmental samples of salt, brackish, and fresh water for both high (ppM) and low (ppB) levels of 19 elements. The purpose of this research was the development of analytical methods for identification and quantitation of inorganic hazardous chemicals involved in transportation-related spills. In particular, the effect of alkali metal enhancement on sample analysis was investigated.

49185 (LBL—1(Vol.2)(Pts.2-2A)) **Survey of instrumentation for environmental monitoring. Volume 2, Parts 2 and 2A. Water.** (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Dec 1978. 531p. Univ. of California, Berkeley $7.00.

Current information is presented to keep technological advances up-to-date in LBL-1, Vol. 2 entitled WATER. Instructions are given for outdated material. New material relates to water monitoring equipment and determination of metals in water. (PCS)

49186 **Aquatic impact.** pp III.1-III.36 of Power plant cumulative environmental impact report. Annapolis, MD; Maryland Department of Natural Resources (1978).

Because of the high reproduction rates of the plankton and good tidal mixing at existing plants, depletion of plankton populations has not occurred. Spawning occurs throughout the Bay for the species of fish present here, so local depletions are insufficient to decrease Bay populations. Impingement totals are small compared to

mortality due to other sources. In addition, efforts to reduce these totals are now underway at all three existing plants, Calvert Cliffs, Morgantown, and Chalk Point. Habitat modification effects, usually more subtle in nature, have minor, localized impacts. Coupled together, the power plant monitoring studies show a low cumulative impact on the mesohaline environment. The major area of concern within this region is the impact of cooling water withdrawals upon the nursery and spawning areas of striped bass and other anadromous species. Possum Point and Vienna have the highest potential for impact. New facilities planned for this region (Douglas Point, Summit, and Vienna) would increase withdrawals. The overall impact upon striped bass due to entrainment drops from an estimated 6.6% entrainment (upper bound) of the eggs and larvae spawned in the Maryland portion of the Bay at present to an estimated 3.4% (upper bound) after 1987. The addition of Douglas Point and Summit is more than off-set by the retirements of the once-through cooling units at Vienna. No impingement data are available at any of the present plants; however, degraded water quality at the Baltimore and Washington plants appears to have severely restricted fish populations in these waters. The proposed plants are expected to have no major impacts in the areas of impingement or habitat modification due to the small amount of water withdrawn.

49187 Air quality and oil spill implications of Alaskan oil importation into southern California. Kahane, S.W. Los Angeles, CA; Univ. of California (1978). 253p. University Microfilms Order No. 78-11,357.

Thesis (Ph. D.).

The proposed siting of the Standard Oil of Ohio (SOHIO) marine terminal and storage facilities in Long Beach, California was discussed. SOHIO proposes to transport 500,000 barrels/day of Alaskan oil through the Port of Long Beach. The air pollutant emissions associated with each of the various activities of the marine terminal were discussed. Various operational scenarios were developed to estimate emissions during routine and emergency conditions. Tanker fuel combustion in port and in transit, project-induced electricity generation, and storage of the unloaded crude oil could result in significant hydrocarbon, nitrogen oxide, sulfur oxide and particulate matter emissions. Emergency tanker operations and accidental oil spills in port or along the coastal shipping lanes could be potential major sources of hydrocarbon emissions. Potential local and regional impact receptor zones were identified and maximum increases in ambient pollutant levels were calculated. Emission impacts from routine project operations would have a minimal impact on local and regional air quality. Emergency operations or accidents occurring in port could have an adverse impact on regional ozone levels. Emergency operations in the transit lanes are not expected to have adverse impacts on on-shore air quality. The tanker accident and oil spill indications of the SOHIO project were examined in the context of expected alternate energy supply and demand importation scenarios. Tanker accident and oil spill statistics were used as a basis for spill forecasts. These scenarios indicated that implementation of the SOHIO project would reduce the total number of tanker calls at southern California ports by allowing surplus Alaskan and Western oils to be shipped to midwest markets via pipeline.

RADIOACTIVE MATERIALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 48534, 48536, 49143, 49259

49188 (EML—356, pp I.25-I.46) **Apparent distribution of ^{228}Ra and ^{228}Th between solution and particles in the waters of the Middle Atlantic Bight.** Feely, H.W. (Queens Coll., New York, NY); Kipphut, G.W.; Trier, R.M.; Kent, C. 1 Jul 1979.

In Environmental quarterly, March 1—June 1, 1979.

The mean residence time of thorium is shorter in the waters above the inner continental shelf of the Middle Atlantic Bight than it is in the near surface waters above the continental slope. It is therefore expected that a larger fraction of the thorium is attached to suspended particulates in shelf waters than in the near-surface waters of the open ocean. In apparent confirmation of this, it was found that filtration of samples of surface water through glass fiber filters removes about 20% of the ^{228}Th from slope water and outer shelf water, and about 45% of the ^{228}Th from mid-shelf and inner-shelf water.

49189 (RLO—2227/T30-2) **Cycling of transuranic radionuclides in the Columbia River, its estuary, and the North Pacific Ocean. Progress report, February 1, 1978—February 15, 1979.** Beasley, T.M.; Holton, R.L. (Oregon State Univ., Corvallis (USA). School of Oceanography). 1979. Contract EY-76-S-06-2227-030. 50p. Dep. NTIS, PC A03/MF A01.

Progress from February 1978 through January 1979 on the measurement of radionuclides in the Columbia River and its estuary, with principal emphasis on plutonium isotopes is reported. The goal is to budget the inventory of transuranic radionuclides in the Columbia River system below the Hanford Complex and to estimate the amounts of Pu and Am being carried to the Northeast Pacific Ocean by the river. The results to date have led to conclusions of some importance to the Department of Energy. These are as follows: (1) previously published data on the concentrations of plutonium in McNary reservoir are incorrect. The reported analyses show Pu concentrations significantly lower than those reported by Battelle; (2) sedimentation rates in McNary reservoir do not appear to be as high as those estimated by previous workers. Using Pu and ^{137}Cs subsurface maxima and ^{238} ^{239} ^{240}Pu ratios, it is concluded that the sedimentation rates in the lower portion of McNary reservoir near the Oregon shore are between 4 and 5 cm/yr and decrease dramatically as the Washington shore is approached. Sedimentation rates at Ice Harbor Dam on the Snake River and at Bonneville Dam on the Columbia are about 2 cm/yr; (3) in the Columbia River estuary where fine sediments are accumulating at a rate of about 3 to 4 cm/yr, plutonium does not appear to be migrating from depth toward the surface.; (4) evidence suggests that the contribution of the eight plutonium production reactors to the integrated plutonium inventory of Columbia River sediments is small; (5) a surprising fraction of the plutonium in Columbia River water is not retained by 0.3μ millipore filters; and (6) in certain regions Columbia River sediments contain rather high mean plutonium loads (mCi/km^2). Each of these topics is discussed as well as the results of participation in both national and international quality control and intercalibration exercises. (ERB)

WATER

REFER ALSO TO CITATION(S) 48224, 49163

AQUATIC ECOSYSTEMS AND FOOD CHAINS

REFER ALSO TO CITATION(S) 49271

49190 (EML—356, pp I.509-I.531) **Studies of element incorporation by marine phytoplankton with special reference to barium.** Bankston, D.C.; Fisher, N.S.; Guillard, R.R.L.; Bowen, V.T. (Woods Hole Oceanographic Inst., MA). 1 Jul 1979.

In Environmental quarterly, March 1—June 1, 1979.

Small populations of various species of marine phytoplankton were batch-cultured in natural seawater media, under controlled conditions. Each culture was harvested by filtration during, or (in a few exceptional cases) after, the phase of exponential growth, dried, ashed, and then analyzed for barium, copper, and silicon by a technique employing dc plasma optical emission spectrometry. Within the pooled sample of algal clones studied, and within each of three phylogenetic subsets of this sample, barium uptake was positively correlated with that of copper. The heaviest accumulators of barium and copper were the dinoflagellates. The diatoms and coccolithophores studied were low accumulators of these elements. The uptake of barium and copper in several of the groups investigatd was significantly lower in silicon-enriched, than in unenriched, media. Certain algae having no known nutritive requirement for silicon, nevertheless accumulated it in sizeable amounts from silicon-enriched media.

THERMAL EFFLUENTS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 49273

49191 (ANL/EES-TM—44) **Overview of the issues surrounding thermal discharges in the Des Plaines River.** (Argonne National Lab., IL (USA)). Apr 1979. Contract W-31-109-ENG-38. 64p. Dep. NTIS, PC A04/MF A01.

This review effort was undertaken to clarify and, if possible, quantify the issues surrounding the thermal input into the lower Des Plaines River from the Commonwealth Edison Joliet Electrical Generation Facility. The central issue is whether or not a reduction of the thermal discharge from the facility would produce beneficial environmental effects. This issue is clouded due to the fact of a number of environmental problems. These problems include: the river water quality, sediment quality, and barge traffic impacts. These variables, coupled with the uncertain future stream volume and conflicting data, prevent any simplistic conclusions from being drawn. Thus, any short-term study can only result in an overview of the situation.

SITE RESOURCE AND USE STUDIES

REFER ALSO TO CITATION(S) 49193, 49194

REGULATIONS

REFER ALSO TO CITATION(S) 49186

49192 (ORNL/TM—6811) **Effect of Florida's water law modifications on Power Plant Siting.** Rosemarin, C.S. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 39p. Dep. NTIS, PC A03/MF A01.

This study builds on a project which examined the water law of each of twenty-seven states in the eastern United States. The main purpose of the present work is to determine whether energy production facilities will have a legally sustainable right to available fresh water supplies in times of water shortage. Florida was selected for examination because a previous study identified parts of the state as regions which may encounter difficulties in providing water for energy production. In the early 1970s the Florida Legislature acted on the two components of this issue, water resource allocation and energy facility siting. The Florida Water Resources Act was based on a model law which was devised for Florida. The Act vested regulatory authority in the Florida Department of Environmental Regulation (DER) and five water management districts, into which it divided the state. It also established a system whereby most users must acquire a permit as a prerequisite to water use. Electric generation facilities were exempted from this requirement by the Florida Electrical Power Plant Siting Act. The purpose of this legislation is to implement a one-stop siting procedure for power plants. The governor and cabinet decide on final certification for a plant, but only after balancing the need for power against expected environmental impacts. Two significant problems were identified which indicate that power plants may not have a legally sustainable right to available fresh water supplies in times of shortage. First, almost no priority of use has been established among the various classes of permits as is required by the Water Resources Act. Consequently, some confusion remains in determining what will occur in the event of a drought. Second, it remains unclear whether the governor and cabinet, DER, or water management districts have authority to limit water use in times of water shortage.

ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

SOCIAL AND ECONOMIC STUDIES

REFER ALSO TO CITATION(S) 49147

ENVIRONMENTAL IMPACT STATEMENTS

REFER ALSO TO CITATION(S) 48235

49193 (NP—23837(Vol.1)) **Final environmental statement: proposed 1979 Outer Continental Shelf oil and gas lease sale 58A.** (Bureau of Land Management, New Orleans, LA (USA). New Orleans Outer Continental Shelf Office). 1979. 441p. Bureau of Land Management, New Orleans, LA.

This proposed oil and gas lease sale in the western and central Gulf of Mexico includes 122 tracts located on the Outer Continental Shelf in federal waters offshore of the States of Texas, Louisiana, Mississippi, and Alabama. These proposed tracts comprise approximately 582,529.75 acres ranging from 3 to 165 nautical miles (6 to 189 kilometers) from shore in water depths of 6 to 500 meters. Pending the Secretary of the Interor's decision, this proposed lease sale is tentatively scheduled for November 1979. Discussion is presented on the following topics: description of the proposal, description of the environment, environmental impacts of the proposed action, mitigating measures, adverse impacts which cannot be avoided, relationship between local short-term uses of environment and enhancement of productivity, irreversible commitment of resources, alternatives to proposed action, and consulation and coordination. This proposed lease sale may result in incremental damage to localized marine and terrestrial biological organisms and habitats, air and water quality, cultural and recreational resources, commercial fishing, shipping and military operations, as a result of exploratory drilling, platform and pipeline construction, production drilling and accidents. (JGB)

49194 (NP—23837(Vol.2)) **Final environmental statement: proposed 1979 Outer Continental Shelf oil and gas lease sale 58A.** (Bureau of Land Management, New Orleans, LA (USA). New Orleans Outer Continental Shelf Office). 1979. vp. Bureau of Land Management, New Orleans, LA.

Maps of the area affected by the proposed oil and gas lease sale (No. 58A) in the western and central Gulf of Mexico included in 122 tracts located on the Outer continental Shelf in federal waters offshore of the States of Texas, Louisiana, Mississippi, and Alabama are presented. These proposed tracts comprise approximately 582,529.75 acres ranging from 3 to 165 nautical miles (6 to 189 kilometers) from shore in water depths of 6 to 500 meters. Approximately 58% of the tracts are gas prone, 4% are oil prone, and 38% are both oil and gas prone. Twelve maps of the affected area on the following subjects are included: submarine physiography of the Gulf of Mexico; selected hurricanes affecting the southern United States OCS are 1954 to 1977 and damaging tropical cyclones 1901 to 1955; index of topographic bathymetric mapping for the southeastern United States OCS area at a scale of 1:250,000; lease status and major public areas; overlay of proposed tracts ICS sale No. 58A; geologic and geomorphic features; bottom sediments, vegetation, and endangered wildlife; recreation, cultural, and undersea features; coastal zone, offshore fisheries and EPA dumping sites; generalized land use and oceanography; infrastructure, accidents, and undersea features; and geothermal and geopressure zones.

BIOMEDICAL SCIENCES, BASIC STUDIES

REFER ALSO TO CITATION(S) 49253

BEHAVIORAL BIOLOGY

REFER ALSO TO CITATION(S) 49171, 49207

49195 (LA—7254-PR, pp 86-90) **Investigations at the Los Alamos National Environmental Research Park.** Foxx, T.S.; Tierney, G.D.; Hakonson, T.E. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Progress is reported on the following research projects: status of endangered and threatened plant species; archaeological surveys and salvage activities within the LA/NERP; observations and activities related to peregrine falcons; and LA/NERP mule deer studies. (HLW)

49196 (NVO—0703-1, pp 30-33) **Ecology of island rat populations.** Jackson, W.B.; Vessey, S.H. (Bowling Green State Univ., OH). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

Studies on the interaction of population density, behavior, and physiological responses of rats included determining the number of incisor scars on the backs of rodents and tail scars; determining internal parasite loads; and determining adrenal weights. Island populations of mice were smaller in body size than mainland populations; external morphological differences were correlated with serologic patterns. Tables are presented to show results. (HLW)

49197 (NVO—0703-1, pp 38-40) **Home range and food habits of Pacific reef sharks (primarily the gray reef shark, Carcharhinus amblyrhynchos).** Nelson, D.R.; McKibben, J.N.; Tricas, T.C.; Cooksey, D.J. (California State Univ., Long Beach). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

Progress is reported on the following studies: determining home range dimensions and stabilities by tracking sharks equipped with ultrasonic transmitters; telemetry instrumentation and techniques for applicability under Enewetak conditions; studies on social behavior, especially aggression toward divers, in relation to space utilization and group organization; and compilation of food-habit data from examination of stomach contents. (HLW)

49198 (NVO—0703-1, pp 41-44) **Survey of the coconut crab population on Ikuran Island, including the collection of demographic data and behavioral ecology of coral reef fishes.** Reese, E.S.; Motta, P.J.; MacDonald, C.; Boucher, L. (Univ. of Hawaii, Honolulu). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

Progress is reported on the following research projects: use of tagging-recapture method to estimate the coconut crab population; studies on demographic data while tagging the crabs and distribution of vegetation; in-depth study of the behavior of 3 species of coral feeders; studies on anatomical adaptations of the feeding apparatus of butterflyfishes and relation of this to feeding behavior; duration of residence and reproductive activity of butterfly and damselfishes;

and survey of reference reefs to assess recovery from the typhoon of May 1972. (HLW)

49199 (NVO—0703-1, pp 45-54) **Patterns in growth and mortality rates of marine snails.** Turk, T.R. (San Diego State Univ., CA). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

Progress is reported on the following research projects: determination of growth and mortality rates of several co-occurring snail species; relationship of growth rate to mortality rate; relationship of growth and mortality to other factors such as recruitment rate and food supply; and studies on differences in life history features between tropical and temperate species. (HLW)

49200 (NVO—0703-1, pp 56-59) **Reproduction, growth, and survival of Enewetak corals.** Stimson, J.; Polacheck, T. (Univ. of Hawaii, Honolulu). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

Progress is reported on the following research projects: reproduction, growth, and survival of corals; determination of how the structure and organization of coral communities develop; determination of how shade producing corals alter the composition of coral communities; growth in colony size measured at depths from 1 to 15 m on lagoon pinnacles and patches; and use of photography to measure survival. (HLW)

49201 (NVO—0703-1, pp 60-61) **Analysis of population structure in Pacific mole crabs.** Wenner, A.M.; Page, H.M.; Fusaro, C. (Univ. of California, Santa Barbara). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

Progress is reported on the following research projects: studies on whether the sex reversal (protandry) hypothesis remains viable for Pacific mole crabs; studies on growth rates of males and females; and indirect estimates of the food distribution pattern around the Enewetak Atoll beaches. (HLW)

49202 (NVO—0703-1, pp 62-63) **Chemical relationship between sea anemones and their symbiotic fishes.** Wittle, L.W.; Wittle, K.S. (Alma Coll., MI). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

It was not possible to detect the presence of a nematocyst inhibitor in the mucus of anemone fish. Observations, however, lead to the belief that even if anemone fish are protected from the stings of anemones due to an inhibitor which the fish receives from the anemone, the relationship is more complicated. The total lack of consistency in anemone response to various tests, e.g., sometimes nematocyst would discharge into control gelatin drops, othertimes they would not, may indicate that anemones have more control (nervous) over their responses than previously suspected.

BIOCHEMISTRY

REFER ALSO TO CITATION(S) 49078, 49171, 49231, 49242, 49245, 49256, 49257, 49261, 49274, 49275

49203 (CONF-790485—2) **Coil form of Poly(rU): a model composed of minimum energy conformers that matches experimental properties.** Broyde, S.; Hingerty, B. (New York Univ., NY (USA). Dept. of Biology; Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 40p. Dep. NTIS, PC A03/MF A01.

From Stereodynamics of molecular systems symposium; Albany, NY, USA (23 Apr 1979).

A model for the coil form of poly (rU) has been obtained which is composed of low energy conformers of UpU. Its calculated, unperturbed dimensions match the experimental characteristic ratio of 17.6 measured for poly (rU). The conformational blend in the model agrees with NMR findings on UpU and poly (rU). The persistence length calculated for the model is of the same order of magnitude as persistence lengths measured for denatured RNA, while persistence lengths of ordered duplexes are much larger. About 82% of the conformers in the model have β,γ = t,g-.

49204 (CONF-790563—1) **Prostaglandin enhancement of skin tumor initiation and promotion.** Fischer, S.M.; Gleason, G.L.; Bohrman, J.S.; Slaga, T.J. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Oak Ridge (USA). Graduate School of Biomedical Sciences). 1979. Contract W-7405-ENG-26. 17p. Dep. NTIS, PC A02/MF A01.

From International prostaglandin conference; Washington, DC, USA (27 May 1979).

Various prostaglandins or indomethacin were applied topically at the same time as the topical application of the tumor promoter 12-O-tetradecanoylphorbol-13-acetate (TPA), or the carcinogen 7,12 dimethybenzanthracene (DMBA). Tumor promotion was enhanced by two groups of prostaglandins and by indomethacin but was inhibited by one prostaglandin group or arachidonic acid. The mechanism operative in each stage is believed to be different. (PCS)

49205 (LA—7254-PR, pp 112-141) **Cellular metabolism.** Gurley, L.R.; D'Anna, J.A.; Barham, S.S.; Deaven, L.L.; Tobey, R.A.; Valdez, J.G. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Progress is reported on the following research projects: histone phosphorylation and chromatin structure during mitosis; developing a model system for the analysis of repair of damaged chromatin; photoreaction of potential carcinogens with DNA; formation and degradation of DNA-binding derivatives of benzo(a)pyrene; flow microfluorometric analysis of BUDR-mithramycin treated cells after x irradiation; Cd uptake and intracellular partitioning in cultured Chinese hamster cells; isolation and characterization of a Cd-resistant variant of line CHO cells; and heparin release of heparan sulfate from the cell surface. (HLW)

49206 (LA—7254-PR, pp 174-181) **Organic and biochemical synthesis group (H-11).** Whaley, T.W.; Williams, T.M. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Studies on organic syntheses with stable isotopes include descriptions of new methods for the preparation of labeled compounds. Syntheses of the following compounds labeled with ^{13}C are discussed: valine, methyl oleate, acetone, taurine, thymine, glucose, and ethyl acetate. Other studies on biochemical syntheses using ^{13}C are discussed with regard to algae and Escherichia coli. Utilization of stable isotopes in research is discussed with regard to national stable isotopes resource research and mechanistic studies of organic reactions using stable isotopes. (HLW)

49207 (NVO—0703-1, pp 55) **Toxins and biomedical agents of marine organisms.** Scheuer, P.J.; Furstenwerth, H.; Yunker, M. (Univ. of Hawaii, Honolulu). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

Progress is reported on the following research projects: molecular structures of invertebrate constituents that are biologically active in human physiology or that form the basis of inter- and intraspecific communication between marine invertebrates; and use of underwater photographic equipment to document collections of Palythoa tuberculosa which is the only sizable known source of palytoxin under US jurisdiction. (HLW)

49208 **Sodium—potassium adenosine triphosphatase activity of human lymphocyte membrane vesicles: kinetic parameters, substrate specificity, and effects of phytohemagglutinin.** Segel, G.B.; Kovach, G.; Lichtman, M.A. (Univ. of Rochester School of Medicine and Dentistry, NY). *J. Cell. Physiol.;* **100**: No. 1, 109-118(Jul 1979).

We have prepared human blood lymphocyte membrane vesicles of high purity in sufficient quantity for detailed enzyme analysis. This was made possible by the use of plateletpheresis residues, which contain human lymphocytes in amounts equivalent to thousands of milliliters of blood. The substrate specificity and the kinetics of the cofactor and substrate requirements of the human lymphocyte membrane Na^+, K^+-ATPase activity were characterized. The Na^+, K^+-ATPase did not hydrolyze ADP, AMP, ITP, UTP, GTP or TTP. The mean ATPase stimulated by optimal concentrations of Na^+ and K^+ (Na^+, K^+-ATPase) was 1.5 nmol of P/sub i/ hydrolyzed, μg $protein^{-1}$, 30 min^{-1} (range 0.9 to 2.1). This activity was completely inhibited by the cardiac glycoside, ouabain. The K/sub m/ for K^+ was approximately 1.0 mM and the K/sub m/ for Na^+ was approximately 15 mM. Active Na^+ and K^+ transport and ouabain-sensitive ATP production increase when lymphocytes are stimulated by PHA. Na^+, K^+-ATPase activity must increase also to transduce energy for the transport of Na^+ and K^+. Some studies have reported that PHA stimulates the lymphocyte membrane ATPase directly. We did not observe stimulation of the membrane Na^+, K^+-ATPase when either lymphocytes or lymphocyte membranes were treated with mitogenic concentrations of PHA. Moreover, PHA did not enhance the reaction velocity of the Na^+, K^+-ATPase when studied at the K/sub m/ for ATP, Na^+, K^+ or Mg^{++}, indicating that it does not alter the affinity of the enzyme for its substrate or cofactors. Thus, our data indicate that the increase in ATPase activity does not occur as a direct result of PHA action on the cell membrane.

49209 **Analytical techniques for cell fractions. XXIII. A stable thermal gradient device for heat denaturation studies on proteins.** Anderson, N.L.; Eisler, W.J.; Anderson, N.G. (Argonne National Lab., IL). Contract W-31-109-ENG-38. *Anal. Biochem.;* **91**: 441-445(1978).

The ISO—DALT two-dimensional electrophoretic system, based on the method of O'Farrell, is capable of performing large numbers of analyses on complex mixtures of proteins. However, both separations employed are carried out under dissociating or

denaturing conditions and no enzyme activities are readily observable in the analyzed proteins. In order to identify the spots corresponding to particular enzymes, it is therefore necessary to employ some nondestructive resolving technique first and as a second step to perform both enzyme and two-dimensional electrophoretic analyses on the fractions generated. By correlating enzyme activity with intensity of various spots on the two-dimensional gels throughout the series of initial fractions, identifications can be made. This approach, unlike the more direct immunoprecipitation methods, requires the running of large numbers of enzyme analyses and two-dimensional gels and some convenient initial resolving procedure. Convenient and rapid techniques for the analyses and gels have been described previously in this series and elsewhere. This paper deals with the use of selective denaturation in a temperature gradient as an initial resolving procedure and describes a simple thermal gradient device for generating such a gradient.

49210 Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977). 357p. (CONF-7610168—).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

Separate abstracts were prepared for the 24 papers presented at the conference. (HLW)

49211 Univ. Paris, France. Buvet, R. pp 21-39 of Energetics of coupled biochemical processes and of their chemical models. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

It seems that these biochemical energy transfer processes which so extensively determine what living systems are, are merely based upon what could be named an arbitration principle between energetical and stoechiometrically relevant kinetical determinations of chemical processes, which could be expressed thus: among all stoechiometrically possible reactions from given substrates, those occurring are the energetically easiest ones, however this criterion has to be taken into account only among the kinetically feasible ones. Nevertheless, even more important than this conclusion is its bearing, particularly relevant to the origin of life, that, in many cases, the complicated and diversified molecular properties of living systems appear ultimately based upon a few dynamical simple principles, and were only complexified by the diversity of situations which can be met with in carbon chemistry into aqueous media, associated with all possible evolutionary refinements linked with the re-using of formerly formed products or structures as catalysts.

49212 Energetics of protein-lipid interaction. Peeters, H.; Rosseneu, M. (Instituut voor Wetenschappelijk Onderzoek, Brugge, Belgium). pp 55-66 of Energetics of coupled biochemical processes and of their chemical models. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

The synthesis and catabolism of plasma lipoproteins in liver and intestine involves degradation and transfer of their lipid and protein moiety with concommittant energy release. This experimental study was devoted to the thermodynamics of phospholipid-apoprotein reassembly by isothermal microcalorimetry. Apoprotein-phospholipid binding is characterized by a negative free energy and enthalpy change and a positive entropy change. The contribution of weak ionic binding between lysine, arginine, and acidic residues and phosphate and choline head groups of the phospholipids could be evaluated from this study. Lipid-binding segments were identified in the apoprotein sequences, where hydrophobic and ionic binding occur. It is proposed that synthetic polypeptides with a structure similar to that of the segments identified could be used in phospholipid transfer processes between lipoproteins.

49213 Iron—sulphur proteins and energy conversion systems. Hall, D.O. (King's Coll., London, England). pp 67-80 of Energetics of coupled biochemical processes and of their chemical models. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

Iron—sulfur (Fe—S) proteins contain iron and usually inorganic sulphide coordinated directly to a protein through cysteine residues. They are known to have important electron transfer functions in photosynthesis, nitrogn fixation, oxidative metabolism, steroid synthesis, nitrate and sulphite reduction, and other processes. A considerable number of membrane-bound Fe—S proteins have also recently been detected in chloroplasts, chromatophors, and mitochondria by electron paramagnetic resonance. There are at least three different types of center in Fe—S proteins containing 4Fe + 4S, 2Fe + 2S, or 1 Fe, and all coordinatd to cysteine sulfurs. Fe—S proteins catalyse oxidation—reduction reactions between -600 mV and +350 mV (hydrogen electrode = -420 mV). Synthetic analogues of the three different types of Fe—S centers have been synthsized which show properties close to those of the proteins. Studies of Fe—S proteins and their synthetic analogues undoubtedly has importance in understanding biological electron transport reactions and may also indicate the analogous functions of Fe—S centers in artificial (chemical) systems and in biological systems.

49214 Structure and function of ATP synthase. Guatheron, D.C.; Godinot, C. (Univ. Claude Bernard, Villeurbanne, France). pp 89-102 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

The biochemistry of ATP is discussed with regard to the following: sources of energy; overall organization of ATP synthase; mechanisms of ATP synthesis; inhibitor and genetic studies; reconstitution of functional ATP-synthase from isolated components; and functional groups involved in ATP-synthase. (HLW)

49215 Model systems reconstructed from bacteriorhodopsin. Packer, L.; Konishi, T.; Shieh, P. (Univ. of California, Berkeley). pp 119-128 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

Our studies with bacteriorhodopsin incorporated into liposomes and planar membrane systems have demonstrated that this pigment generates large and stable photoelectrical potentials. Studies with bivalent cations indicate that they are useful in indicating the orientation, i.e., the degree to which oppositely oriented bacteriorhodopsin molecules are present in reconstituted systems. Applied electrical fields also appear to orient purple membrane fragments at the planar membrane interface. Two methods have been found to markedly improve the stability of planar membrane systems contaning bacteriorhodopsin. The conventional planar membrane system is much improved by the presence of polymers in the membrane-forming solution. The use of phospholipid-impregnated filter membranes combined with bacteriorhodopsin liposomes made of the same lipid exhibit considerable stability upon storage over a period of months. Improvement of its intrinsic stability also appears to be benefitted by chemical crosslinking. Using bifunctional chemical crosslinking reagents of defined chain length to treat bacteriorhodopsin the the dark- or light-adapted state has shown that the protein portion of this molecule probably has slightly different conformations in these two conditions. This is evidenced by differences in proton pump activity and chemical modification of lysine and tryptophan residues; the results are consistent with the presence of a channel for forming proton gradients.

49216 Poential of H_2 production by photosynthetic preparations from chloroplasts and cyanobacteria. Packer, L.; Tel-Or, E.; Papageorgiou, G. (Univ. of California, Berkeley). pp 129-134 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

Heterocysts of the cyanobacteria, N. muscorum and A. cylindrica contain an active reversible hydrogenase. Since the consumption is greater than H_2 production in heterocysts, this system may serve to regulate the channeling of electrons from molecular H_2 to nitrogenase in these cells. Heterocycts are relatively poorly permeable to external reductants, thus gaseous H_2 is the hydrogen donor par excellence, providing a readily permeable form of reducing power. Both hydrogenase and nitrogenase are present in hetrocysts. Nitrogenase catalizers N_2 fixation to NH_3 and H_2 evolution which decreases the yield of N_2 fixation (10). In the absence of artificial mediators like methylviologen the hydrogenase of heterocycts would function unidirectionally, i.e., H_2 uptake. Thus, as shown in the diagram below, H_2 uptake by hydrogenase in heterocysts could be important in augmenting the rate and efficiency of N_2 fixation in the cyanobactria by establishing a mechanism for recycling reducing power in the form of H_2 lost by the leak in nitrogenase.

49217 Energy compartmentation in the cell. Vignais, P.M. (CEN-G, Grenoble, France). pp 135-151 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

The turnover of energy-rich matter involves the phosphorylation-dephosphorylation cycles of the adenine nucleotides and the oxidation—reduction cycles of the pyridine nucleotides. These two processes are interconnected since oxidation of the reduced nucleotides (NADH) by the respiratory chain, in the mitochondrial membrane, is coupled to the phosphorylation of ADP and produces ATP. Many energy-yielding or energy-consuming reactions are connected by a way of feed-back cycles to the phosporylation state of

adenine nucleotides. Mitochondria constitute compartments within the cell. In addition to making ATP they can concentrate a number of metabolites. They can maintain these metabolites at a concentration higher than that in the cytosol. Within the mitochondria these metabolites are processed, preserved, and used for definite purposes. This mitochondrial compartmentation is well illustrated by differences between mitochondrial matrix and cytosol in the phosphorylation state of adenine nucleotides and also in the redox state of the NAD-couple. The communication between the mitochondria and the cytosol is brought about by specific mitochondrial anion transport systems. Thus there exists an ADP/ATP carrier, a phosphate carrier and carriers for di- and tricarboxylic anions of the Krebs cycle. As a result of the operation of these carriers, reducing equivalents can cross the mitochondrial membrane and ATP can be exported from the mitochondria. These carriers also allow the cytosol to gain mitochondrially synthesized citrate. In mammalian liver, the cytosol is able to store chemical energy in the form of glycogn or of long chain fatty acids when ATP, citrate, and reducing quivalents are in excess.

49218 Calcium transport in biologial membranes. Carafoli, E. (Swiss Federal Inst. of Technology, Zurich). pp 153-1744 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

Considering then the universal role of Ca^{2+} as a secondary messenger it becomes obvious why its concentration within cells has to be precisely regulated at very low levels. From what has been discussed at the beginning of this paper, it is also clear that Ca^{2+} was a potentially good chemical choice, during evolution, for a universal messenger. The fact that the choice was indeed made, has probably more than a simple chemical reason, and one could offer various speculations on it. One that has been advanced very recently is particularly interesting. The cell must maintain, due to unavoidable metabolic demands, a high internal concentration of phosphate, a fact which mandatorily demands that the high extracellular Ca^{2+} concentration does not equilibrate with the intracellular milieu, to avoid precipitation of Ca phosphate salts. As a consquence, Ca^{2+} pumps had to be developed to eject the continuously penetrating Ca^{2+} from the cells. Out of necessity, then, conditions were developed in evolution that were ideal for a role of Ca^{2+} as an intracellular messenger.

49219 Analysis of the structure of the photosynthetic apparatus based on functional experiments. Joliot, P. (Inst. of Biology and Physical Chemistry, Paris, France). pp 175-184 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

The structure of the pigment apparatus and of the electron transfer chain is described. It was concluded that diffusion processes do not play an important role in the electron transfer reactions. Most of the electron carriers are associaated to one another and are tightly bound to the membrane. It appears that the efficiency of the photosynthetic process is related to a high degree of structuration of the photosynthetic apparatus both with respect to the light-collecting pigment antenna and the electron transfer chain. (HLW)

49220 Bioenergtic mechanism of photosynthesis results by pulse methods. Witt, H.T. (Technical Univ., Berlin, Ger.). pp 185-197 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

This report is restricted mainly to results obtained by light and electric pulse methods. In a first stage the repetitive light pulse spectroscopic method was applied. For the characterization of the molecular events changes of optical properties were used. In this way informations were obtained on every migration, chlorophyll reactions, and electron transfers. In a second stage the combination of this method with the electrochromic effect leads to information on electrical events, vectorial pathways, anisotropical organizations, and phosphorylation. As a consequence of the obtained results in a third stage recently excitation of phosphorylation with external electric field pulses were performed. The results encourage one to use this method for further insights into the mechanism of phosphorylation and for analysis of other events.

49221 Conversion of solar energy into energy-rich phosphate compounds. Baltscheffsky, M. (Univ. of Stockhold, Sweden). pp 199-207 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

The final elucidation of the respective roles of membrane potential, proton gradient, and conformational changes in the phosphorylation mechanism in chromatophores from photosynthetic bacteria has yet to come, and is of course closely linked to the corresponding mechanism in chloroplasts and in animal mitochondria. Of what practical use may chromatophores be then. At present, probably the best use is as a model for the conversion of solar energy to electrical and/or chemical energy. It may in this context be worthwhile to point out, that recently the group of Dr. Skulachev in Moscow has reported that R. rubrum chromatophores incroporated into a planar phospholipid membrane, will give rise to transmembrane electrical potential of about 200 mV on illumination. This may point towards possible future practical application of the bacterial photosynthetic system as a solar energy converter.

49222 Electron transfer in photosynthetic systems: energy conservation in photosynthetic electron transport of chloroplasts. Trebst, A. (Ruhr Univ., Bochum, Ger.). pp 209-220 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

The following topics are discussed: primary reactions in photosynthetic electron flow in chloroplasts; photophosphorylation; particle reactions and artificial energy conservation in photosynthesis; phosphorylation in the dark; and native or artificial light driven metabolic processes in photosynthesis. (HLW)

49223 Energy and materials via photosynthesis. Calvin, M. (Univ. of California, Berkeley). pp 231-259 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

As we learn the detailed structures of each of the crucial components in the photoelectron transport system and how they are constructed it should be possible to reconstruct the photochemicl system for generating molecular hydrogen from water in a relatively stable synthetic system without the need of an agricultural environment. This hydrogen could be used directly as fuel, or be a component in the construction of hydrocarbon fuels from hydrogen-poor sources such as coal and shale. It might even be possible to construct a carbon dioxide (or nitrate) reduction system as well, and thus have the capability of generating reduced carbon (or nitrogen) in a similar synthetic system. This kind of totally synthetic system which emulates and simulates the chloroplast membrane activity of the green plant may well be, in the future, another system of capturing the energy of the sun and producing a storable fuel directly from it. Such a device would not compete with either land or water regions or the earth which might ultimately be required to fulfill the food needs of the growing population of the world and the increasing expectations of that population. We are currently in the process of constructing such a synthetic membrane, and we know what one side will probably be, but we are still not certain as to the events on the oxygen-producing side.

49224 Adaptation of bioenergetic processes in relation to various environments and to the size of the organism. Schoffeniels, E. (Univ., Leige, Belgium). pp 261-270 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

The flow of energy between source and sink of variable chemical nature can be considered as explaining the origin of the different metabolic sequences which one finds in all cells. This can be interpreted as the result of the amplification of fluctuations appearing when the system departs from the position of equilibrium and produces a dissipative state structure. The diversification of proton and electron acceptors results in a more complete utilization of the available energy. As a consequence the size of organisms has increased and the new constraint of heat dissipation has led to evolve means of decreasing the energy metabolism.

49225 Direct conversion of radiant into electrical energy using plant systems. Allen, M.J. (Shell Research Ltd., Sittingbourne, England). pp 271-274 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

Plants are known to be one of the more efficient energy converter systems. Within the plant leaf are to be found the chloroplasts whose prime function is the utilization of radiant energy for the synthesis of carbohydrate from carbon dioxide and water. The chloroplast has within its structure the thylakoid which is responsible for the production of reducing equivalents (electrons) and oxyten from water when subjected to irradiation by light of appropriate wave lengths. The stroma of the chloroplast, which contains the required enzyme systems, utilize the reducing equivalents for the reduction of carbon dioxide. As it is the thylakoids which produce

the reducing equivalents, it was felt that this system would serve as a useful model for the conversion of radiant to electrical energy. Although the conversion efficients obtained appear interesting, it must be emphasized that these systems, because of their biological components, are relativly short-lived. It may be that as the technology progresses a longer life can be obtained. However, at best the thylakoid can only be viewed as a model for an effective photovoltaic device whose components are yet to be elucidated.

49226 Utilization of the photosynthetic apparatus of green plants and algae for the production of gaseous hydrogen. Evstigneev, V.B. (Inst. of Photosynthsis, Pushchino-on-Oka, USSR). pp 275-284 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

It seems worthwhile to emphasize that the photosynthetic hydrogen problem put forward, in fact for the first time, investigations of some aspects of the intimate mechanism of photosynthesis onto the level of problems having a nearest practical significance. Quite lately an opinion has been widespread, that in spite of being indisputable that the problem of photosynthesis, that is of an essence of biochemical, biophysical, and other processes taking place in chloroplasts, could be used for practice only in rather remote future. Actually, although there is an indisputable relation between the primary processes of absorption of light energy and its transformation into chemical energy, occurring in chloroplast lamellas and productivity of agricultural plants, but this relation is only indirect and depends on different intermediate factors, especially under conditions of open fields. In the case of photosynthetic hydrogen problem some results of photosynthesis mechanism investigations can be used for practical aim immediately.

49227 Hydrogen and methane production through microbial photosynthesis. Benemann, H. (Univ. of California, Berkeley). pp 285-297 of Living systems as energy converters. Buvet, R.; Allen, M.J.; Massue, J.P. (eds.). New York, NY; Elsevier/North-Holland, Inc. (1977).

From European conference on living systems as energy converters; Pont-'a-Mousson, France (18 Oct 1976).

Hydrogen production from water by photosynthesis is discussed with regard to biophotolysis by subcellular components and proteins of plants, algae, and bactria; time course of production by the chloroplast—ferredoxin—hydrogenase system; and economic considerations. Heterocystous blue-green algae are discussed and the only organisms meeting the minimum requirements for a biophotolysis system for practical applications. The role of photosynthetic bacteria in the decomposition of organic compounds to carbon dioxide and hydrogen is discussed. Oxidation ponds or lagoons are discussed as a method of waste treatment; organic nutrients in the wastes are converted into an algal biomass. Methane fermentations of the algae biomass followed by recycling of the digested algae sludge recovers most of the energy and nutrients. Using the principle of recyling algae digester effluents it would be possible to remove all nutrient limitations and operate a methane production facility as economically feasible. (HLW)

TRACER TECHNIQUES

49228 Sequence of an oligonucleotide derived from the 3′ end of each of the four brome mosaic viral RNAs. Dasgupta, R.; Kaesberg, P. (Univ. of Wisconsin, Madison). *Proc. Natl. Acad. Sci. U.S.A.;* 74: No. 11, 4900-4904(Nov 1977).

A 3′-terminal oligonucleotide fragment, 161 bases long, can be obtained from each of the four brome mosaic virus RNAs by means of nuclease digestion. Like the four intact brome mosaic virus RNAs, each fragment accepts tyrosine in a reaction catalyzed by wheat germ aminoacyl-tRNA synthetase. The complete nucleotide sequence of the RNA 4 fragment has been determined by use of standard radiochemical methods. Comparative data for the fragments from RNAs 1, 2, and 3 show that they have nearly the same sequence as the RNA 4 fragment. The eight bases adjacent to the 3′-terminus of the RNA 4 fragment are identical in sequence to the eight terminal bases of tyrosine tRNA from Torula utilis and eleven interior bases are identical in sequence to eleven bases encompassing the anticodon region of tyrosine tRNA from Saccharomyces cerevisiae, T. utilis, and Escherichia coli. Nevertheless, reasonable base-pairing schemes yield, at best, a distorted cloverleaf secondary structure.

CYTOLOGY

REFER ALSO TO CITATION(S) 49205

49229 (LA—7254-PR, pp 107-112) Cell-cycle-specific chromosome damage following treatment of cultured CHO cells with 4′-[(9-acridinyl)-amino] methanesulphon-m-anisidide-HCl (m-AMSA chloride). Deaven, L.L.; Campbell, E.W.; Nock, A.; Tobey, R.A. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

The following studies were conducted: effects of BUDR and MAC on sister-chromatid exchanges; mitotic progression of exponentially growing cells; relative frequencies of aberrant metaphase cell types following treatment of asynchronous populations with MAC; and all-cycle sensitivity of cells exposed to MAC and ^{3}H-thymidine. (HLW)

49230 (LA—7254-PR, pp 144-150) Teratocarcinoma: an alternative for embryos in the study of teratogenesis. Swartzendruber, D.E.; Cram, L.S.; Cox, K.S. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Progress is reported on the following research projects: teratogenesis studies on growth and differentiation of teratocarcinoma cells with the flow cytometric instrumentation; flow microfluorometric detection of cycling and noncycling cells; and use of lymphocytes in studies on cellular damage to the immune system resulting from exposure to physical and chemical agents associated with developing oil shale technology. (HLW)

49231 (LA—7254-PR, pp 150-153) Cell preparation. Crissman, H.A.; Kissane, R.J.; Stevenson, A.P.; Orlicky, D.J. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Progress is reported on the following research projects: characterization of the proliferation capacity and protein content of tumor cell populations at various stages of tumor development, and analysis of an energy transfer phenomenon for two fluorescent DNA-specific compounds: propidium iodide and mithramycin. (HLW)

49232 (LA—7254-PR, pp 154-168) Development of instrumentation for rapid cell analysis and sorting. Leary, J.F.; Cram, L.S. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Progress is reported on the following projects: fluorescent peroxidase-antiperoxidase triple antibody labeling of cell surface and intracellular antigens; identification of lymphocyte cell surface alloantigens from the Blocus of chicken genotypes able or unable to regress Rous sarcoma virus-induced tumors; detection and recovery of viable cell hybrids by fluorescence resonance energy transfer and fluorescence activated cell sorting; fluorescence resonance transfer measurements of virus-cell interactions in permissive infection and in transformation; high- efficiency flow cytometers; the use of electrical impedance for cell classification; development of a dual-laser excitation flow cytometric system; nanosecond fluorescence spectroscopy; analysis of DNA histograms from asynchronous and synchronous cell populations; a high-sensitivity flow chamber; and fluorescent and enzymatic studies of mammalian blood cells. (HLW)

49233 (LA—7254-PR, pp 168-169) Instrument for static light-scattering measurements on individual cells. Mullaney, P.F.; Burger, D.E.; Salzman, G.C. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

The Biophysics and Instrumentation Group (H-10) at Los Alamos has pioneered the use of light-scattering techniques in flow cytometry for the detection and classification of cells. The method has proven useful for enhancing the signal-to-noise ratio in measurements on weakly fluorescent cells, as well as identification of various types of leukocytes, algae, and attempts at identifying the various cell types present in specimens obtained by exfoliative cytology. In the instrument under development, the detector consists of a photodiode array. With the auxiliary lens absent, the unit functions as a conventional optical microscope and a medium resolution cell image is recorded. Once the auxiliary lens is placed in the optical train, the scattering pattern corresponding to that same cell is recorded. Both sets of information are digitized with a microprocessor. The information is then fed to a PDP 11/45 computer for comparison of the image/scatter pattern.At the present time, the optical system is nearing completion. Electronic design and fabrication are under way. Completion of the unit is scheduled for mid-1978. Once completed and operational, this instrument will represent a unique capability in the Western Hemisphere. In addition to direct DOE support, funds for this work have been provided through an interagency agreement with the National Cancer Institute.

49234 Biological responses to biomedical ultrasound. Miller, M.W.; Kaufman, G.E. (Univ. of Rochester, NY). pp 215-223 of Symposium on biological effects and characterizations of ultrasound sources. Hazzard, DeW.G.; Litz, M.L. (eds.). Rockville, MD; Bureau of Radiological Health (1977).

From Symposium on biological effects and characterizations of ultrasound sources; Rockville, MD, USA (2 Jun 1977).

The research results described indicate that biomedical ultrasound is capable of inducing perturbations in several plant and animal systems: these perturbations include reduced growth rates, reduced mitotic indices, induced cell wall shattering, induced chromosomal anomalies, reduced macromolecular synthesis, cell lysis, loss of cell viability, and induction of giant cells. All of these parameters, with the exception of the cell wall shattering and lysis, generally pertain directly to effects on the genetic and regulatory mechanisms of the cells. What appears evident at this juncture is that biomedical ultrasound is capable of affecting eukaryotic cell progression.

GENETICS

REFER ALSO TO CITATION(S) 48074, 49229, 49256, 49261, 49267, 49276

49235 (CONF-790537—3) **CHO/HGPRT mutagenicity assay. II. Genetic basis of 6-thioguanine resistance.** O'Neill, J.P.; Hsie, A.W. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 11p. Dep. NTIS, PC A02/MF A01.

From Cold Spring Harbor symposium on quantitative mammalian cell mutagenesis and mutagen screening; Cold Springs Harbor, NY, USA (6 May 1979).

An essential aspect of any attempt to study mutation induction in mammalian cells is the demonstration that genetic alterations are the bases for the altered phenotypes. We have defined reproducible conditions for the selection of 6-thioguanine-resistant (TG/sup r) variants of Chinese hamster ovary (CHO) cells. It is known that many such variants contain altered forms of the enzyme hypoxanthine (Hx)-guanine phosphoribosyl transferase (HGPRT). Our question was whether every variant colony which develops under our conditions has properties consistent with a genetic alteration at the HGPRT locus. We considered other possible mechanisms for the TG resistance such as: (a) colony formation by wild-type cells which have escaped the toxic effects of TG as a result of the death of cells and release of purine bases and metabolites into the medium and/or as the result of depletion of medium TG due to inherent decay and cellular metabolism leading to a loss of selection stringency; (b) phenotypic resistance due to some transient, adaptive response in cellular physiology, such as increased rates of purine biosynthesis; (c) stable resistance as a result of mutations at other loci, such as alterations in TG uptake or alterations which affect intracellular levels of purine nucleotides or PRPP. Our conclusion from these studies is that the TG/sup r/ phenotype which is quantified by use of the CHO/HGPRT system does represent genetic alterations, and that we are performing quantitative mutagenesis is determinations with this system. (PCS)

49236 (LA—7254-PR, pp 105-107) **Mutagenicity assessment: life-cycle and cell-membrane mutants.** Barnhart, B.J.; Cox, S.H.; Okinaka, R.T. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Studies were conducted on induction of mutations in Chinese hamster cells by chemical pollutants from crude and retorted shale oil and spent shale and near uv light. Mutagenic effects of x radiation and ^{238}Pu were also studied. (HLW)

49237 **Use of pre- and post-implantation mammalian embryos to study the cytogenetic effects of mutagens on parental germ cells.** Hansmann, I. (Universitaet Goettingen, Germany). *Genetics;* **92**: No. 1, S141-S142(May 1979).

METABOLISM

49238 (BNL-NUREG—25603) **Alternatives to the bio-heat transfer equation.** Wulff, W. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 6p. (CONF-790317—1). Dep. NTIS, PC A02/MF A01.

From Thermal characteristics of tumors; New York, NY, USA (14 Mar 1979).

The author concluded that the future challenge of modeling transport processes in living tissues lies in the development of extrinsic constitutive equation, primarily for the motion of fluids through capillaries (equivalent to Darcy's laws of liquid flow rough porous media). One must not confuse the issues arising from modeling hypotheses with questions of inconsistency in applying the principles of rational mechanics. (PCS)

49239 (COO—3326-77) **Photochemistry and enzymology of photosynthesis. Progress report, November 1, 1978—March 31, 1979.** Kok, B.; Golbeck, J. (Martin Marietta Labs., Baltimore, MD (USA)). Apr 1979. Contract EY-76-C-02-3326. 11p. Dep. NTIS, PC A02/MF A01.

The authors continued seeking the source of electrons for the Calvin cycle in bundle sheath chloroplasts of C_4 plants using corn or spinach leaves that are free from mesophyll but still retain their photochemical activity. Results indicate that cross transfer of electrons between photosynthetic chains occurs both upstream with plastoquinone and downstream with cytochrome f. (PCS)

49240 (NVO—0703-1, pp 22-23) **Uptake and release of dissolved nitrogen by reef organisms.** D'Elia, C.F. (Woods Hole Oceanographic Inst., MA); Webb, K.L. Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

Short chamber incubations on reef flat holothurians were used to determine the relationship between size and nitrogen and phosphorus excretion rates. Results showed that larger animals regenerate or produce more nitrogen per unit of oxygen consumed or phosphorus produced than smaller animals. Results of studies on ammonia release by Holothuria atra suggest a significant role for holothurians in nitrogen regeneration on the reef flat. The role of algal symbionts in coral nutrition was also investigated. (HLW)

49241 (NVO—0703-1, pp 35-37) **Uptake, assimilation, and fate of inorganic nitrogen in Pocillopora.** Marian, R.E. (Univ. of California, Los Angeles). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

Tracer techniques, using ^{15}N, were applied to the examination of N assimilation and translocation in the coral Pocillopora. The results suggested that translocated N is incorporated into host tissue constituents. Such internal recycling of available N may be one possible adaptation allowing reef corals to flourish in a nutrient-poor environment. (HLW)

MEDICINE

REFER ALSO TO CITATION(S) 49246, 49282

UNSEALED RADIONUCLIDES IN DIAGNOSTICS

49242 **Analysis of proteins of mouse sarcoma pseudotype viruses: type-specific radioimmunoassays for ecotropic virus p30's.** Kennel, S.J.; Tennant, R.W. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *J. Virol.;* **30**: No. 3, 729-734(Jun 1979).

Murine sarcoma virus pseudotypes were prepared by infection of nonproducer cells (A1-2), which were transformed by the Gazdar strain of mouse sarcoma virus, with Gross (N-tropic), WN1802B (B-tropic), or Moloney (NB-tropic) viruses. The respective host range pseudotype sarcoma viruses were defined by the tritration characteristics on cells with the appropriate Fv-1 genotype. Proteins from virus progeny were analyzed by sodium dodecyl sulfate—polyacrylamide gel electrophoresis. Bands present in both the 65,000- and the 10,000- to 20,000-molecular-weight regions of the gel distinguished the pseudotype viruses from their respective helpers. Furthermore, two protein bands were noted in the p30 region of murine sarcoma virus (Gross), one corresponding to Gross virus p30, and another of slightly slower mobility. However, since the mobility of the putative sarcoma p30 is nearly indentical to that of WN1802B, its presence could not be established by sodium dodecyl sulfate—polyacrylamide gel electrophoresis. Type-specific radioimmunossays for Gross virus p30 and for WN1802B p30 were applied for analysis of pseudotype preparations, and among several ecotropic viruses tested, only the homologous virus scored in the respective assay. By use of these assays, pseudotype viruses were found to contain only 8 to 48% helper-specific p30's; the remainder is presumably derived from the sarcoma virus.

49243 **Krypton-81m: a better radiopharmaceutical for assessment of regional lung function in children.** Li, D.K.; Treves, S.; Heyman, S.; Kirkpatrick, J.A. Jr.; Lambrecht, R.M.; Ruth, T.J.; Wolf, A.P. (Children's Hospital Medical Center, Boston, MA). *Radiology;* **130**: No. 3, 741-747(Mar 1979).

Supported by the Dept. of Energy.

Krypton-81m, an inert, radioactive gas with a physical half-life of 13 seconds was used to evaluate regional lung ventilation in 25 pediatric patients. The results suggest that Kr-81m has several advantages over previous methods employing xenon-133. These include: more favorable physical characteristics for imaging with present scintillation cameras; ease of performance of the examinations; improved resolution and multiple views with better detection and localization of abnormalities; and a much lower dose to the patient.

EXTERNAL RADIATION IN DIAGNOSTICS

49244 Direct radiographic magnification for skeletal radiology. Genant, H.K.; Dol, K.; Mall, J.C.; Sickles, E.A. (Univ. of California, San Francisco). *Radiology;* **123**: 47-55(Apr 1977).

From 61. scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL, USA (30 Nov 1975).

Recent advances in technology have made radiographic magnification of the skeleton clinically feasible. A new electron gun micro-focal tube combined with new high-resolution recording systems were used to perform magnification radiography which was then compared with conventional contact radiography. Quantitative evaluation included measurements of speed, contrast, resolution, and noise. Qualitative evaluation included an analysis of 215 clinical cases in which both techniques were used. The superior image quality of direct radiographic magnification is confirmed and the clinical areas in which it proved most helpful are defined.

MICROBIOLOGY

REFER ALSO TO CITATION(S) 49177, 49256

49245 Picosecond and steady state, variable intensity and variable temperature emission spectroscopy of bacteriorhodopsin. Shapiro, S.L. (Los Alamos Scientific Lab., NM); Campillo, A.J.; Lewis, A.; Perreault, G.J.; Spoonhower, J.P.; Clayton, R.K.; Stoeckenius, W. *Biophys. J.;* **23**: No. 3, 383-393(Sep 1978).

The bacteriorhodopsin emission lifetime at 77°K has been obtained for different regions of the emission spectrum with single-pulse excitation. The data under all conditions yield a lifetime of 60 +- 15 ps. Intensity effects on this lifetime have been ruled out by studying the relative emission amplitude as a function of the excitation pulse energy. The lifetime is related to previously reported values at other temperatures by studying the relative emission quantum efficiency as a function of temperature. These variable temperature studies have indicated that an excited state with an emission maximum at 670 nm begins to contribute to the spectrum as the temperature is lowered. Within the experimental error the picosecond data seem to suggest that this new emission may arise from a minimum of the same electronic state responsible for the 77°K emission at 720 nm. A correlation is noted between a 1.0-ps formation time observed in absorption by Ippen et al and a time extrapolated from relative quantum efficiency measurements and the 77°K fluorescence lifetime that is reported.

MORPHOLOGY

REFER ALSO TO CITATION(S) 49177

PATHOLOGY

REFER ALSO TO CITATION(S) 49234, 49278

49246 Hairy cell leukemia: an analysis of the chromosomes of 26 patients. Golomb, H.M.; Lindgren, V.; Rowley, J.D. (Univ. of Chicago, IL). Contract EY-76-C-02-0069. *Virchows Arch., B;* **29**: 113-120(1978).

The chromosomes from 26 patients with hairy cell leukemia (HCL) were studied to ascertain the frequency and types of consistent chromosomal abnormalities. Samples from 21 patients were obtained from peripheral blood cultures grown 24 and 48 h without phytohemagglutinin, or from bone marrow samples. Two male patients had similar, consistent abnromalities; one patient's karyotype was 46, X, +12; that of the second was 46, X, +C marker. In the latter case, the distal long arm of the C marker most closely resembled chromosome No. 12 from band q14 to q terminal, but the short arm and proximal long arm were of undetermined origin. Both karyotypes lacked the Y chromosome. Nine of the 21 patients had abnormalities in single cells. One patient had, in one sample, a single abnormal cell with an extra No. 3 and an extra No. 12 (48, XY, +3, +12), and in a later sample, a second cell of poor morphology which also could have been trisomic for No. 12. Another patient had one cell with an unusually bright short arm, as well as two cells, with different abnormalities, both involving the short arm of chromosome No. 1. The two patients with consistent chromosome abnormalities had rapidly progressive disease in spite of splenectomy, and their clinical course from the time of diagnosis was relatively short (5 and 7 months, respectively).

PHYSIOLOGICAL SYSTEMS

REFER ALSO TO CITATION(S) 49239, 49261

49247 (NVO—0703-1, pp 18-19) **Acousticolateralis system in sharks: hearing and electroreception and nervous systems of corals.** Bullock, T.H. (Univ. of California, San Diego, La Jolla); Corwin, J.T.; Reetz, W.P.; Ebbeson, S.; Lopez, M.D. Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

Responses were studied in the hind brain, midbrain, and forebrain of sharks for acoustic, electric, and photic stimuli. Results confirmed the role of the parietal fossa as an acoustic window into the head and indicated that the inner ear and macula neglecta were the main sites of acoustic sensitivity in sharks. Responses of corals to controlled electric stimuli of different frequencies were studied by means of cine film. (HLW)

49248 (NVO—0703-1, pp 20-21) **Hearing in sharks and radioisotope intake histories of sharks.** Corwin, J.T.; Reetz, W.P. (Univ. of California, San Diego, La Jolla). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

The following studies were conducted: microautoradiographic determination of the rate of sensory cell generation in the ears of sharks using a tritiated precursor to DNA; determination of brain centers receiving input from the macula neglecta; determination of the relation between sensory cell age and recently described variations in ultrastructure; analysis of radionuclide activity in the skeletons of sharks with restricted home ranges; and description of anatomical features of the tiger shark ear and their relation to directional hearing ability. (HLW)

TRACER TECHNIQUES

REFER ALSO TO CITATION(S) 49243

PUBLIC HEALTH

REFER ALSO TO CITATION(S) 49281

49249 (JPRS—73135, pp 16-24) **New advances in public health care in the Ukrainian SSR.** Romanenko, A.E. 2 Apr 1979. Translated from Vrach. Delo; No. 11, 1-8(1978).

In Translations on USSR science and technology: Biomedical and Behavioral Sciences, No. 60.

Increased interest in working conditions and preventive health measures is reported. A review of progress since 1977 policy changes is presented. (PCS)

49250 (JPRS—73135, pp 25-32) **Dispensary observations of healthy seamen and those ill with isochemic heart disease.** Aleynikova, L.I.; Saltykov, I.I. 2 Apr 1979. Translated from Vrach. Delo; No. 11, 79-84(1978).

In Translations on USSR science and technology: Biomedical and Behavioral Sciences, No. 60.

A four-year surveillance of 299 sailors revealed high prevalence of diseases of the cardiovascular system, especially ischemic heart disease. Therapeutic and preventive measures were presented. (PCS)

AGRICULTURE AND FOOD TECHNOLOGY

REFER ALSO TO CITATION(S) 49150, 49151, 49166

49251 (LA-UR—79-788) **Livestock farm management, electronics and automation.** Nott, S.B. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 15p. (CONF-790718—1). Dep. NTIS, PC A02/MF A01.

From American Agricultural Economics Association meeting; Pullman, WA, USA (29 Jul 1979).

Microcomputer hardware is being mass marketed which can keep livestock farm records and aid management decision making. Electronic equipment is being sold to automatically control and monitor individual animal feed consumption and milk production. Body temperature can be electronically measured. Agricultural economists should analyze this new technology.

BIOMEDICAL SCIENCES, APPLIED STUDIES

49252 (JPRS—73387) **Translations on USSR science and technology. Biomedical and behavioral sciences, No. 63.** 4 May 1979. Translation of various papers. 53p. NTIS.

The report contains information on aerospace medicine, agrotechnology, bionics and bioacoustics, biochemistry, biophysics, environmental and ecological problems, food technology, microbiology, epidemiology and immunology, marine biology, military medicine, physiology, public health, toxicology, radiobiology, veterinary medicine, behavioral science, human engineering, psychology, psychiatry and related fields, and scientists and scientific organizations in biomedical fields.

49253 (JPRS—73135) **Translations on USSR science and technology: Biomedical and Behavioral Sciences, No. 60.** 2 Apr 1979. Translation of various articles. 57p. NTIS.

The report contains information on aerospace medicine, agrotechnology, bionics and bioacoustics, biochemistry, biophysics, environmental and ecological problems, food technology, microbiology, epidemiology and immunology, marine biology, military medicine, physiology, public health, toxicology, radiobiology, veterinary medicine, behavioral science, human engineering, psychology, psychiatry and related fields, and scientists and scientific organizations in biomedical fields.

RADIATION EFFECTS

REFER ALSO TO CITATION(S) 48772

IN ANIMALS

REFER ALSO TO CITATION(S) 49260

RADIATION EFFECTS ON CELLS

EXTERNAL SOURCE

REFER ALSO TO CITATION(S) 49205, 49236

49254 (AD-A—061537) **The synergistic effect of ultrasound and ionizing radiation on human lymphocytes. Doctoral thesis.** Burr, J.G. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1978. 216p. NTIS PC A10/MF A01.

Lymphocytes in human peripheral blood were exposed to various combinations and sequences of heat, ultrasound and/or ionizing radiation and their chromosomes analyzed for gross chromosomal aberrations. The combined use of ultrasound and ionizing radiation showed a statistically significant increase in exchange aberrations for the simultaneous ultrasound (3.0 W/sq cm, CW, 1.1 MHz) and ionizing radiation (300 and 100 rads, Co-60, 120 rads/min) exposures. Ultrasound used before or after irradiation caused no aberrations and extending the time of ultrasound exposure after irradiation had no effect over that of the ultrasound only during the radiation exposure. The combined use of 43 C heat (same temperature as that induced by 3.0 W/sq cm, CW, 1.1 MHz ultrasound) and ionizing radiation showed basically the same significant results as the combined ultrasound and ionizing radiation exposures. In addition, the combined use of heat at various temperatures (24 C thru 43 C) and ionizing radiation showed that all chromosome aberration types and the number of aberrant metaphase figures increased with increasing temperature. A statistical comparison of the heat plus ionizing radiation and the ultrasound plus ionizing radiation exposures showed no statistically significant difference between heat or ultrasound for any type aberration. (Author)

49255 (LA—7254-PR, pp 169-173) **Negative pion radiobiology studies.** Raju, M.R.; Amols, H.I.; Bain, E.; Carpenter, S.G.; Cox, R.A.; Robertson, J.B.; Tobey, R.A.; Walters, R.A. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

The following studies were conducted: OER and RBE for pion beams of different peak widths; a combination of sensitizers with high LET radiations; effect of negative pions on cells plated on glass and plastic surfaces; cell survival as a function of depth for modulated negative pion beams; and age response of CHO cells exposed to peak pions. (HLW)

RADIATION EFFECTS ON MICROORGANISMS

BASIC STUDIES

49256 (CONF-790676—3) **Genetic and physiological factors affecting repair and mutagenesis in yeast.** Lemontt, J.F. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 53p. Dep. NTIS, PC A04/MF A01.

From Conference on DNA repair and mutagenesis in bacteria; Atlanta, GA, USA (25 Jun 1979).

Current views of DNA repair and mutagenesis in the yeast Saccharomyces cerevisiae are discussed in the light of recent data, and with emphasis on the isolation and characterization of genetically well-defined mutations that affect DNA metabolism in general (including replication and recombination). Various pathways of repair are described particularly in relation to their involvement in mutagenic mechanisms. In addition to genetic control, certain physiological factors such as cell age, DNA replication, and the regulatory state of the mating-type locus, are shown to also play a role in repair and mutagenesis.

RADIATION EFFECTS ON ANIMALS

MAN

49257 **Amino acid substitution: its use in detection and analysis of genetic variants.** Popp, R.A.; Hirsch, G.P.; Bradshaw, B.S. (Oak Ridge National Lab., TN). *Genetics;* **92**: No. 1, S39-S47(May 1979).

Techniques of chemical analysis, amino acid sequencing and autoradiography are being used to study the frequency of incorporation of normally noncoded amino acids into hemoglobins and seminal fluid proteins. We are studying, by the sequencing of radiolabeled proteins followed by the recovery of [^{3}H] isoleucine phenylthiohydantoin by high-performance liquid chromatography, the frequency at which normally noncoded isoleucine is incorporated into hemoglobin because of base-substitution mutations versus translational errors. Irradiation increases the isoleucine content of human hemoglobin and the frequency of substitution of isoleucine for specific amino acids in rabbit hemoglobin. Studies to date indicate that these techniques have been developed sufficiently for initial analysis of the potential of drugs and environmental pollutants to induce base-substitution mutations in mammalian somatic cells.

49258 (JPRS—72826) **Space biology and aerospace medicine.** Translation of *Kosm. Biol. Aviakosmicheskaya Med.;* **13**: No. 1, 3-75(14 Feb 1979). 113p. NTIS.

The report contains articles concerning the selection and training of cosmonauts; evaluation and analysis of accumulated data to facilitate the on-going transition from orbital to interplanetary flights; research aimed at guaranteeing safety on long flights and reliability of the human component of the man-spaceship system; space psychology and physiology; environmental problems and control (spacecraft habitability, effects of radiation and weightlessness, etc.) and telemetry.

49259 **Radiological effects.** pp IV.1-IV.28 of Power plant cumulative environmental impact report. Annapolis, MD; Maryland Department of Natural Resources (1978).

Environmental monitoring in the vicinity of the Calvert Cliffs Nuclear Power Plant has been shown the radiation dose to the public from plant operation to be quite small. Calculations from the reported release rates yield 0.2 mrem whole body dose and 0.6 mrem skin dose for the calendar quarter of maximum release. Radioactivity discharges to the Chesapeake Bay have resulted in detectable concentrations of /sup 110m/Ag, ^{58}Co, and ^{60}Co in sediments and shellfish. The area yielding samples with detectable concentrations of plant effluents extends for roughly six miles up and down the western shore, with maximum values found at the plant discharge area. The radiation dose to an individual eating 29 doz oysters and 15 doz crabs (5 kg of each) taken from the plant discharge area would be about 4/1000 mrem whole body dose and 0.2 mrem gastrointestinal tract dose (about 0.007% and 0.5% of the applicable guidelines, respectively.) Comparison of these power plant-induced doses with the fluctuations in natural radiation dose already experienced by the public indicates that the power plant effects are insignificant. The natural variations are tens of times greater than the maximum doses resulting from Calvert Cliffs Power Plant. Although operations to date provide an insufficient basis to predict radiological impact of the Calvert Cliffs Plant over its operational lifetime, available data indicate that the plant should continue to operate with insignificant radiological impact, well within all applicable guidelines.

VERTEBRATES

REFER ALSO TO CITATION(S) 49196, 49271

49260 (BNL—26069) **Response to and recovery from acute sublethal gamma radiation in the Amazon molly, Poecilia formosa.** Woodhead, A.D.; Setlow, R.B. (Brookhaven National Lab., Upton, NY (USA)). May 1979. Contract EY-76-C-02-0016. 25p. (CONF-790562—1). Dep. NTIS, PC A02/MF A01.

From Radiation effects on aquatic organisms; Tokyo, Japan (May 1979).

Acute irradiation of the Amazon molly with a sublethal dose of 1,000 rad caused some damage to the intestinal tract and to the haematopoietic system. Histologically, the intestine appeared to have regenerated by the end of a week; damage to the haematopoietic tissue appeared more slowly, but repair was almost complete some two months later. Nevertheless, recovery to the intestine cannot have been entirely completed in seven days, since the fish did not feed well for the following two weeks. After this, there were no obvious deleterious effects upon the survival and viability of the fish, although irradiated fish weighed less at the termination of the experiment.

49261 (CONF-790676—2) **Repair in fertilized eggs of mice and its role in the production of chromosomal aberrations.** Generoso, W.M. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 18p. Dep. NTIS, PC A02/MF A01.

From Conference on DNA repair and mutagenesis in bacteria; Atlanta, GA, USA (25 Jun 1979).

The fertilized egg may influence the yield of dominant-lethal mutations produced from chemical treatment of male postmeiotic germ cells to a small or large extent depending upon the mutagen used and the competence of the egg to repair the premutational lesions induced. The strain of females has small influence on the yield of dominant-lethal mutations induced by TEM or EMS in spermatids and spermatozoa. On the contrary, it has large influence in the case of IMS. In addition to this difference, TEM and EMS induce high levels of heritable translocations at these germ cell stages while IMS is practically ineffective even though doses of these chemicals used produced comparable levels of dominant-lethal mutations. These differences between EMS and TEM on one hand and IMS on the other, were explained as a function of the types of chromosomal lesions present at the time of repair activity and whether or not chromosomal aberrations are already fixed at the time of postfertilization pronuclear DNA synthesis.

49262 (LA—7254-PR, pp 13-17) **External radiation.** Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Progress is reported on the following external radiation studies: delayed radiation injury of gut-exposed and gut-shielded mice; and late biological effects of radiation injury as influenced by radiation dose, dose rate, and age at the onset of exposure. (HLW)

49263 (LA—7254-PR, pp 37-38) **Immunology.** Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Studies on immunology included the effect of low-level whole-body x irradiation on splenic immunologic function and allogeneic fetal tissue restoration of lethally x-irradiated mice. An animal model was developed for testing T- and B-cell number and function as they may be related to carcinogenesis. (HLW)

49264 (NVO—0703-1, pp 12-16) **House mice on Enewetak Atoll.** Berry, R.J. (Royal Free Hospital, London, England). Feb 1979.

In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

Several thousand mice were exposed to radiation during the atomic test period and then flown to Oak Ridge for study. It is thought that the present populations were formed by mice that escaped from these colonies. Mice were trapped and observations were made on body size, organ weight, and hematological characteristics. Genetic differences in mice from different islands are discussed. (HLW)

49265 Unscheduled DNA synthesis (DNA repair) in the germ cells of male mice: its role in the study of mammalian mutagenesis. Sega, G.A. (Oak Ridge National Lab., TN). *Genetics;* **92**: No. 1, S49-S58(May 1979).

Unscheduled DNA synthesis (UDS) has been found to occur in vivo in specific meiotic and postmeiotic germ cell stages of male mice after mutagen treatment. Techniques and problems involved in measuring UDS are discussed, including the administration of tritium-labeled thymidine ([^{3}H]dT) and mutagens, and the detection of UDS using liquid scintillation counting (LSC) and autoradiography. The sensitivity of detection of UDS in the male germ cells is compared to that of other genetic end points, and the possible role of UDS in the actual repair of genetic damage is considered. Possible areas for future research on the role of UDS in repair of genetic damage in the mouse are suggested.

49266 Changes in mammalian sperm morphology after x-ray and chemical exposures. Wyrobek, A.J. (Univ. of California, Livermore). *Genetics;* **92**: No. 1, S105-S119(May 1979).

Sperm head morphology in mammals provides a unique approach to quantiating the effects of environmental agents on the germ cells. In unperturbed male mice, the sperm of each genotype can be reproducibly characterized by the shape of the head, the overall percent of sperm with head-shape abnormalities and the types of shape abnormalities seen. Genetic studies show that sperm shape is highly heritable, and that the fraction of abnormal sperm is controlled by a multitude of autosomal factors plus probably involvement of the sex chromosomes.--Exposure to ionizing radiation or certain chemical agents in vivo leads to dosage-dependent increase in the fraction of sperm with head-shape abnormalities. These results are documented in numerous mammalian species, including man. Evidence from mouse studies suggests that in general sperm shape is affected by those agents considered to be mutagenic. Since sperm samples are easily obtained and sperm morphology is rapidly quantitated, these observations suggest that sperm morphology in the mouse may be an applicable screen for environmental effects on germ cells. Changes in sperm are also seen in the offspring of male mice exposed to irradiation or a chemical alkylating agent. Preliminary evidence suggests that these changes represent heritable sperm shape abnormalities that can be further transmitted to subsequent generations.--The problems of determining the genetic implications of induced sperm abnormalities in exposed males are discussed. It is suggested that sperm morphology testing may have a direct application in man.

49267 Detecting mutations expressed during early development of cultured mammalian embryos. Pedersen, R.A.; Goldstein, L.S. (Univ. of California, San Francisco). *Genetics;* **92**: No. 1, S143-S151(May 1979).

Mammalian embryo culture systems can be used to study dominant lethal, recessive lethal, and visible mutations that are expressed between fertilization and early stages of organogenesis. The incidence of dominant lethal mutations has been determined for cultured mouse embryos by morphological observations during preimplantation and early post-implantation growth in vitro, and the mechanisms of dominant lethal mutations have been studied cytogenetically. Recessive lethal mutations have been studied with cultured embryos, although they can be initially detected only with appropriate breeding protocols. Visible mutations that are due to deletions or single-site base alterations in the DNA can be detected in embryos by isoelectric focusing and gel-electrophoresis techniques.--The principal advantage of cultured embryos for detecting mutations and studying the mechanism of action of particular mutagens is that embryos are accessible for analysis before death with a minimum of indirect maternal effects. The primary disadvantages, which may be alleviated with improved culture conditions, are that only a limited amount of tissue is available, attrition and retardation occur, and offspring are not recovered for further breeding studies.

49268 In vivo somatic mutation systems in the mouse. Russell, L.B. (Oak Ridge National Lab., TN). *Genetics;* **92**: No. 1, S153-S163(May 1979).

In an effort to meet the need for a fast and cheap in vivo prescreen for inherited mammalian point mutations, a somatic forward-mutation method, originally developed in an x-ray experiment, has more recently been tested in work with chemical mutagens. The method makes use of coat-color mutations because the gene product is usually locally expressed, mosaics can be detected with minimal effort, and opportunities for making comparison with induction of germinal point mutations are greatest.--Following treatment of embryos that are heterozygous at specific coat-color loci, various induced genetic changes can result in expression of the recessive (RS) in clones derived from mutant melanocyte precursor cells. However, other events, such as decrease in the number of precursor cells, or disturbed differentiation, can also result in spots, which with careful classification can usually be distinguished from RS's on the basis of their location and color. When this is done, the relative RS frequencies for a series of compounds at least roughly parallel the relative spermatogonial mutation rates. The fact that easily measurable (though low) RS rates are obtained with compounds that have yielded negative results in spermatogonial tests is not surprising in view of the fact that RS's can be caused by several mechanisms besides point mutation.--In spite of the parallelism observed in one laboratory, the usefulness of the in vivo somatic mutation method as a prescreen could come to be doubted because of major discrepancies between results of similar experiments at different laboratories. However, It appears probable that at least some of these discrepancies are due to failure to discriminate between spots that probably resulted from melanocyte insufficiency and spots that resulted from expression of the recessive.--Reverse somatic mutation systems can potentially avoid some of the pitfalls of forward mutation systems. Such system are still in developmental stages.

RADIONUCLIDE EFFECTS - INTERNAL SOURCE

REFER ALSO TO CITATION(S) 49236

MAN

REFER ALSO TO CITATION(S) 48536, 49259

ANIMALS

REFER ALSO TO CITATION(S) 49271

49269 (LA—7254-PR, pp 18-37) **Hot particle program.** Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

A test system was developed using very uniform microspheres of plutonium-loaded ceramic ZrO_2 permanently lodged in the capillary bed of hamster lungs. The results (previously reported) proved that the predictions were wrong by several orders of magnitude and that diffuse irradiation was the more harmful. They also established that the hamster showed a selective response to lung irradiation, some modalities of exposure being highly tumorigenic while others produced no tumors at all. Some of these modalities were tumorigenic in other rodent species. These results suggested that a lack of tumor induction might be ascribable to the absence of certain crucial factors and that, therefore, the hamster offers special advantages over other experimental rodents in that missing factors can be explicitly supplied in controlled experiments. A similar selectivity appeared with the microsphere modality: a high alpha exposure could be given with minimal apparent trauma and very low tumor incidence. Supplementation with apparently innocuous instillations of iron oxide suspensions then produced a striking increase in tumor incidence.These results appear to have very important implications for both the applied and theoretical aspects of radiation carcinogenesis. Included in this report is an account of another unexpectedly tumorigenic insult: the inhalation of a polydispersed aerosol of PuO_2—ZrO_2. The studies with ^{227}Th, for which the methodology is given below, will investigate the extent to which dose rate is an important parameter. The measurements of chromosome aberrations are part of an effort to develop end points that have shorter response time than tumor development and that will provide additional information about the type and intensity of cellular damage produced by alpha exposures of the lung.

NUCLIDE KINETICS AND TOXICOLOGY

REFER ALSO TO CITATION(S) 49168

MAN

REFER ALSO TO CITATION(S) 49165, 49166

49270 (LA—7254-PR, pp 17-18) **Radionuclide metabolism.** Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Studies on radionuclide metabolism included retention pattern of Co in mice, retention of Ti in mice, and long-term ^{137}Cs retention in a human population. Conclusions from studies on effects of size of dose on retention of Co are briefly discussed. (HLW)

ANIMALS

REFER ALSO TO CITATION(S) 49166, 49270

49271 (RLO—2227-T8-9) **Radioecological studies of amphibians. Final report, September 15, 1968—July 21, 1977.** Willis, D.L. (Oregon State Univ., Corvallis (USA)). Nov 1977. Contract EY-76-S-06-2227-008. 14p. Dep. NTIS, PC A02/MF A01.

The radioecological role of amphibians in freshwater environments was studied. Three distinct aspects were studied: (1) the metabolism of radioecologically important radionuclides in amphibians; (2) the effect of acute doses of radiation on adult amphibians; and (3) the effect of chronic exposure to low radiation dose rates from radionuclide solutions on embryonic and larval amphibians. Twelve radioecologically important radionuclides were investigated in five different amphibian species. This involved tracing uptake from immersion, whole-body retention, and patterns of tissue and organ distribution. In most cases work was done at two different temperatures approximating winter and summer conditions. The radiosensitivity of the rough-skinned newt was determined over a very wide dose range. The same dose-response curve characteristic of mammals was found. However, survival times were greatly prolonged. The effect of environmental temperature on radiosensitivity was also studied. To ascertain evidence for repair mechanisms, a fractionated dose study was carried out. The effect of dose-rate was also studied. The effect of chronic low dose-rates from ^{134}Cs solutions was traced for two frog species. Total dose was a function of time to metamorphosis, which differed by a factor of two in these species. In general, mortality levels exceeded those of controls only at ^{134}Cs concentrations several orders of magnitude greater than MPC levels in drinking water.

PLANTS

REFER ALSO TO CITATION(S) 49166

49272 (LA—7254-PR, pp 61-63) **Radionuclide uptake by vegetable crops in the Mortandad Canyon garden plot during 1976.** Hakonson, T.E.; Gallegos, A.F. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

A study was conducted to determine availability of ^{137}Cs, ^{238}Pu, and ^{239}Pu to vegetables grown in contaminated soil in Mortandad Canyon. A table is presented to show radionuclide concentrations in radish and tomato crops and in soil samples. It was concluded that Cs and Pu in garden soils can be transferred to edible portions of radish and tomato crops and that standard food washing procedures do not remove all of the contamination. Radish bulbs contain 10 times higher Pu concentrations than tomato fruit when grown on the same soil. (HLW)

THERMAL EFFECTS

MICROORGANISMS

49273 (EPRI-EA—1054(Vol.1)) **Synthesis and analysis of ecological information from cooling impoundments. Final report.** Becker, C.D.; Cushing, C.E.; Gore, K.L.; Baker, K.S.; McKenzie, D.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Apr 1979. Contract EY-76-C-06-1830. 115p. Dep. NTIS, PC A06/MF A01.

The effects of a once-through cooling mode of power plant operation on small, essentially closed aquatic ecosystems, represented by cooling impoundments were assessed. The primary objectives were: (1) to synthesize existing ecological data from cooling impoundments with a low load ratio; (2) to analyze these data to derive technically sound conclusions on plant operational impacts; (3) to identify what important effects cannot be assessed with existing data; and (4) to extrapolate the derived conclusions to other ecosystems. Fourteen cooling impoundments were selected and ecological information related to possible plant operational effects was collected and evaluated for these sites. The primary physical effect was the increment of surplus heat from plant condensers to the water body. Chemical changes were minimal, and were usually associated with long-term evaporation of water. Biological effects were largely qualitative, limited to a portion of the fish and plankton populations, and were not reflected at the community or ecosystem level. To the extent that no major ecosystem effects were identified in closed cooling impoundments, they would not be expected in open ecosystems.

VERTEBRATES

REFER ALSO TO CITATION(S) 48533, 49273

CHEMICALS METABOLISM AND TOXICITY

CELLS

REFER ALSO TO CITATION(S) 49229, 49230, 49235, 49236, 49279

49274 **Inactivation of bacteriophage λ during the aerobic oxidation of bisulfite.** Kudo, I.; Miura, A.; Hayatsu, H. (Tokyo Univ., Japan). *Environ. Res.;* **16**: No. 1, 205-215(Jul 1978).

Treatment of bacteriophage λ with 0.0001 to 0.01 M bisulfite ion in the presence of air and a catalytic amount of Mn(II) ion resulted in a rapid decrease in the plaque-forming activity of the phage. The functions of the coat proteins, i.e., the adsorption to the bacteria and the injection of phage DNA into them, were damaged by the treatment. However, the phage DNA was not affected during this treatment with respect to size and transfection activity. This contrasted to the ease with which naked DNA was damaged by the treatment with bisulfite under comparable conditions. Tryptophan, methionine, and 4-thiouridine, all of which are known to react with the free radicals generated during the aerobic oxidation of bisulfite, protected the phage from the attack of the reagents. The results suggested that proteins may be easily impaired by a combined action

of sulfur dioxide and oxygen. Inhalation of sulfur dioxide will offer a situation in which the radicals can be produced near the surface of the respiratory organs. 24 references, tables.

MICROORGANISMS

REFER ALSO TO CITATION(S) 49256

PLANTS

49275 Effects of sulfur dioxide and ozone on growth and metabolites of Ulmus americana seedlings and preliminary studies of immunological techniques for cytokinin analysis. Constantinidou, H.A. Madison, WI; Univ. of Wisconsin (1978). 184p. University Microfilms Order No. 78-14,257.

Thesis (Ph. D.).

Four-month old, actively growing or quiescent Ulmus americana seedlings were exposed to SO_2 (2 ppM for 6 hr), O_3 (0.9 ppM for 5 hr), or SO_2—O_3 (2 ppM SO_2 and 0.9 ppM O_3 for 5 hr, followed by 1 hr exposure to 2 ppM SO_2). Fumigations caused significant reduction in growth of actively growing plants, and in total nonstructural carbohydrates and protein content of actively growing and quiescent plants. Although exposure to pollutants decreased total lipids of quiescent plants, reduction in lipids (up to 28%) was much less pronounced than in carbohydrates or proteins (up to ≃ 65%). Changes in lipid content of actively growing plants were small and in most cases not significant. Growth and metabolite content of treated plants, examined at 1, 7, and 35 days after exposure to pollutants, were reduced least by O_3, more by SO_2, and most by SO_2—O_3 treatment. Sulfur dioxide and O_3 treatments affected growth and metabolite content of roots and tops differently. The effects of SO_2 were more obvious on growing leaves and roots, whereas O_3 had greater effects on metabolites of fully expanded leaves and stems. Effects of SO_2—O_3 treatment on actively growing plants were usually either additive or antagonistic. Only additive effects of the SO_2—O_3 mixture on metabolites of quiescent plants were detected. One week after treatment, differences between the responses of actively growing and quiescent seedlings were relatively small. However, 2 to 3 weeks after fumigation, responses of seedlings to pollution damage were very different. As indicated by expansion of young leaves, the actively growing plants began to recover from the acute pollutant poisoning. In contrast, the quiescent seedlings responded to the imposed stress by accelerated abscission of leaves. Thus, depending on their physiological state at fumigation time, the seedlings responded differently to pollution damage. An immobilized antibody method for purifying cytokinins before analysis was also described.

INVERTEBRATES

REFER ALSO TO CITATION(S) 49156

49276 Anthracene-induced melanotic tumors in Drosophila. Corwin, H.O.; Gottlieb, F.J. (Univ. of Pittsburgh, PA). *Environ. Res.;* **15**: No. 3, 327-331(Jun 1978).

Since polyaromatic hydrocarbons are among the pollutants normally associated with combustion, Drosophila melangoster males and females were fed anthracene, dibenzanthracene, benzpyrene, and pyridine at 0.001, 0.0001, and 0.00001 M throughout the larval development of the flies. Multigeneration tests showed that none of the four agents induced a significant frequency of X-linked mutations. The progeny of anthracene-treated males and females had a significant frequency of melanotic tumor (nonneoplastic, melanized hemocytic aggregates) production. While all three anthracene concentrations induced a statistically significant frequency of tumors, there was no clear-cut indication of a dose response. No such significant tumor forming activity was observed in progeny obtained from parents treated with the other three agents. Tables are included.

VERTEBRATES

REFER ALSO TO CITATION(S) 48533, 49261, 49265, 49266, 49268, 49279

49277 (LA—7254-PR, pp 38-40) **Applied toxicology.** Oct 1978. In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

General screening procedures are discussed with regard to: acute oral toxicity; skin reactions; skin sensitization; conjunctival instillation; dominant lethal assay; and mutagenicity testing. The following preliminary data are tabulated: summary of restoration experiments; summary of toxicants related to their relative toxicities; and summary of toxicity of materials tested in 1977. (HLW)

49278 Early methylmercury signs revealed in visual tests. Evans, H.L. (Univ. of Rochester Medical Center, NY). pp 241-256 of Proceedings of international conference on heavy metals in the environment. Vol. 3. Hutchinson, T.C. (ed.). Toronto, Ontario; Institute of Environmental Studies (1977).

The manuscript describes an experimental preparation and preliminary results which hold promise both as an experimental model of human intoxication and in the search for the earliest, preclinical, signs. The latter requires a determination of the temporal sequence of emerging signs. Since overt signs of methylmercury poisoning seem to reflect damage to the central nervous system, the present study employed behavioral tests suited for repeated measurement during a long exposure and recovery period. The most prominent early signs in monkeys involve sensory impairment. Of these, visual deficits have been the most readily quantified. Reduced sensitivity to extremely dim light could be measured many weeks prior to the appearance of overt signs. Deficits in skin senses and intention tremor also were early signs. Additional signs were described in the temporal progression, from the earliest signs through severe intoxication. With dose and blood mercury concentration held constant, the number and severity of signs progresses as a function of duration of exposure.

MAN

REFER ALSO TO CITATION(S) 49204, 49277

49279 (LA—7254-PR, pp 3-13) **Oil shale toxicology.** Oct 1978. In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Research in the field of oil shale toxicology included studies on the following: industrial hygiene; inhalation of raw and spent shale; intratracheal administration of raw and spent shale; effects of shale on the gastrointestinal tract and the skin; retorted shale and lung histochemistry; oil shale and silica particle effects on Syrian hamster macrophages; and cell damage following in vitro exposure to retorted oil shale. (HLW)

49280 (LA—7254-PR, pp 47-57) **Determination of plutonium in man.** McInroy, J.F.; Boyd, H.A.; Eutsler, B.C.; Stewart, M.D.; Tietjen, G.L. Oct 1978.

In Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January—December 1977.

Progress is reported on the following studies: Pu in tissues of the general population; analytical techniques for measuring Pu in autopsy tissue; health surveillance of Los Alamos Pu workers; epidemiological studies of persons exposed to Pu; and analysis of the human health and ecological consequences of Pu and other transuranics. (HLW)

49281 (PB—289126) **Investigation of selected correlations between industrial activity and community disease. Final report, October 1976—March 1978.** Perry, W.W.; Goldsmith, R.; Mattson, M.E.; Urbanek, M.A.; Bailey, C.B. (Enviro Control, Inc., Rockville, MD (USA)). Aug 1978. Contract EPA-68-01-4304. 498p. NTIS PC A21/MF A01.

The report documents the results of four case studies of correlations between industrial activity and community disease: (1) copper smelting and respiratory/digestive diseases; (2) steel manufacturing and digestive neoplasms; (3) bituminous coal mining and cardiovascular/respiratory diseases; (4) viscose rayon and cardiovascular diseases. The four correlations were found by statistical analyses correlating county-by-county mortality data with industrial data. The case studies consisted of field investigations at specific industrial sites to explore the plausibility of causal relationships between the selected industries and the associated diseases. Overall purpose of the work is to assist in the development of objective and systematic methodology for identifying industrial origins of community disease. Results of the case studies provide a basis for assessing the feasibility of finding causal industry-disease associations by correlating county-by-county industry and mortality data.

49282 Organ mercury levels in infants with omphaloceles treated with organic mercurial antiseptic. Fagan, D.G.; Pritchard, J.S.; Clarkson, T.W.; Greenwood, M.R. (Hospital for Sick Children, Toronto, Canada). *Arch. Dis. Childhood;* **52**: 962-964(1977).

Samples of fresh and fixed tissues from infants with exomphalos treated by thiomersal application were analyzed for mercury content. The results showed that thiomersal can induce blood and organ levels of organic mercury which are well in excess of the minimum toxic level in adults and fetuses. The analysis of fresh and fixed tissues must be carefully controlled against normal tissues in order to interpret mercury levels accurately.

OTHER ENVIRONMENTAL POLLUTANT EFFECTS

REFER ALSO TO CITATION(S) 48113, 49234

49283 **Socio-economic impact.** pp V.1-V.19 of Power plant cumulative environmental impact report. Annapolis, MD; Maryland Department of Natural Rsources (1978).

The construction of an electric generating station may have socio-economic effects upon the community in which it is located. Among the possible effects during construction are changes in population leading to strains in housing, schools, employment, transportation, and increased demands on local government services. The scale of the effects varies according to the population base of the county in which the plant is located and the distance of the site from major metropolitan areas. Increased demands for county and municipal public services also vary during the construction period. In some instances the increased cost of public services can result in large budget deficits at both the county and municipal level as construction period revenue increases fail to keep pace with service costs. In the study case of potential Eastern Shore power plant sites, annual municipal budget deficits were estimated to range from 3 to 21% for nuclear plant construction. The same study projected the largest county deficit at 4%, with other counties experiencing revenues and expenditures which were essentially in balance. After a new plant starts operation, the tax revenue to county government is on the order of several million dollars per year or greater depending on plant size and local tax rates, and the service costs are small.

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 48962

GEOSCIENCES

REFER ALSO TO CITATION(S) 48749, 49126

GEOLOGY AND HYDROLOGY

REFER ALSO TO CITATION(S) 48211, 48215, 49289, 49290

49284 (LA—7883-MS) **Finite element method for studying the transient nonlinear thermal creep of geological structures.** Anderson, C.A.; Bridwell, R.J. (Los Alamos Scientific Lab., NM (USA)). Jun 1979. Contract W-7405-ENG-36. 37p. Dep. NTIS, PC A05/MF A01.

A finite element theory, suitable for describing the long-term transient thermal creep of geomechanical structures where the material obeys an arbitrary type of creep law, is presented. The method takes into account large deformation effects, is stable for the large time steps required to model geophysical phenomena, and accurately simulates changing, incompressible, plastic flow fields. Applications of the theory to the prediction of long-term creep and creep rupture of simple engineering structures are given. The theory is also applied to predict the thermal creep of layered media to study the mechanics of folding and rift formation. 20 figures, 3 tables.

49285 (NUREG/CR—0874) **Recent vertical movement of the land surface in the Lake County Uplift and Reelfoot Lake Basin areas, Tennessee, Missouri and Kentucky.** Stearns, R.G. (Vanderbilt Univ., Nashville, TN (USA). Dept. of Geology). Mar 1979. 41p. NTIS.

Tiptonville Dome, an established tectonic uplift, is one in a 20 mile series of en echelon topographic highs, most or all of which are uplifts. These fetures are too high to have been flooded during the largest historic floods. During these floods they were temporary islands. From Lewis Prairie, at New Madrid in Missouri, five such topographically high areas extend southward across the Mississippi River to Ridgely, Tennessee. Although separated now due to modern river erosion, they were nearly continuous in 1811. Contour trends reveal a squarish topographic bulge west of the flood islands, the western corner of which is near Portageville, Missouri. It may have been uplifted with, but less than, the flood islands. This bulge and topographic highs comprise the Lake County Uplift. Vertical movement is interpreted from variations in elevation of the alluvial plain surface and old soils. Individual features, datums, and vertical movement are estimated. Ridgely Ridge and Tiptonville Dome in Tennessee correlate with positive gravity anomalies, and small earthquakes are concentrated beneath or near them. Thus, these topographic features may be surface manifestations of deep-seated tectonic movements that continue today. 12 figures, 2 tables.

49286 (RHO-BWI-C—30) **Annotated bibliography of the geology of the Columbia Plateau (Columbia River Basalt) and adjacent areas of Oregon.** Bela, J. (Oregon State Dept. of Geology and Mineral Industries, Portland (USA)). Jan 1979. Contract EY-77-C-06-1030. 783p. Dep. NTIS, PC A99/MF A01.

This bibliography containing approximately 2000 entries was prepared by the Oregon Department of Geology and Mineral Industries under Subcontract SA-913 with Rockwell Hanford Operations' Basalt Waste Isolation Program. The objective of the Basalt Waste Isolation Program is to determine the feasibility of storing nuclear waste within the Columbia River Basalt Group. Under the geologic portion of this program, the stratigraphic, structural, tectonic, seismic, and hydrologic aspects of the Columbia Plateau are being examined. Other aspects of the Basalt Waste Isolation Program are concerned with systems integration, engineered barriers, engineering testing, and construction of a near-surface test facility. The area covered in this bibliography comprises that area north of 43°30' latitude and east of the Willamette Meridian, which is located just west of Portland. The bibliographic entries are presented in two forms. The first is an alphabetized listing of all articles dealing with the geology of the Columbia Plateau (Columbia River Basalt) and adjacent areas of Oregon. The second form consists of an alphabetized listing of the entries subdivided under fourteen categories. (RWR)

49287 (RHO-BWI-C—46) **Magnetostratigraphy of the Grande Ronde Basalt Pasco Basin, Washington.** Packer, D.R.; Petty, M.H. (Woodward-Clyde Consultants, San Francisco, CA (USA)). Jan 1979. Contract EY-77-C-06-1030. 75p. Dep. NTIS, PC A04/MF A01.

The paleomagnetic measurements of samples from the holes sampled have shown that there are four magnetic correlation lines, between adjacent flows in holes that have distinctly different mean stratigraphic inclinations, and two magnetic polarity boundaries that can be used for magnetic correlation in the Grande Ronde Basalt in the Pasco Basin. The results of paleomagnetic measurements of samples from the Wanapum Basalt and Saddle Mountains Basalt indicate that the potential for magnetostratigraphic correlation in these sequences is also good.

49288 **Numerical model for saturated—unsaturated flow in deformable porous media. I. Theory.** Narashimhan, T.N.; Witherspoon, P.A. (Univ. of California, Berkeley). *Water Resour. Res.;* **13**: No. 3, 657-664(Jun 1977).

A theory is presented for numerically simulating the movement of water in variably saturated deformable porous media. The theoretical model considers a general three-dimensional field of flow in conjunction with a one-dimensional vertical deformation field. The governing equation expresses the conservation of fluid mass in an elemental volume that has a constant volume of solids. Deformation of the porous medium may be nonelastic. Permeability and the compressibility coefficients may be nonlinearly related to effective stress. Relationships between permeability and saturation with pore water pressure in the unsaturated zone may be characterized by hysteresis. The relation between pore pressure change and effective stress change may be a function of saturation. In the transition zone where pore water pressure is less than atmospheric but greater than air entry value, soil moisture diffusivity as used in soil physics and coefficient of consolidation as used in soil mechanics are shown to be conceptually equivalent. It is believed that this model will be of practical interest in studying saturated—unsaturated systems undergoing simultaneous desaturation and deformation.

GEOPHYSICS

49289 **Geology of the San Francisco Peaks, Arizona.** Updike, R.G. Tempe, AZ; Arizona State Univ. (1977). 505p. University Microfilms Order No. 77-17,885.

Thesis (Ph. D.).

During late Tertiary and most of Quaternary times the San Francisco Peaks and surrounding regions have been an intermittently active volcanic area. The Peaks themselves are the highest mountains in Arizona and their summits form the rim of a composite volcano, with a basal extent of more than 140 km^2. Although the main volcano has not erupted within the past 400,000 years, peripheral eruptions have occurred as recently at 200,000 years ago, and nearby vents have been active during Holocene times. The central part of the volcanic field, in the vicinity of the San Francisco Peaks, might be characterized as a continuum of sporadic basaltic effusions spanning at least the past 6 million years, upon which has been superimposed the intermediate to silicic volcanism of the Peaks themselves in the time span from 2.5 to 0.2 million years B.P. Chemical data listed for the various San Francisco Peaks lavas, peripheral intermediate to silicic centers, and adjacent basaltic lavas suggest that the field is consanguineous. The data do not, however, conclusively discern a parent magma for the field. Often, intermediate and lower slopes of the Peaks and adjacent plateau are veneered with an indurated breccia consisting of a wide range of rock types, varying greatly in size. These debris commonly have fan or digitate morphology and cover several tens of square kilometers. Three major glaciations occurred in the San Franciso Peaks during later Pleistocene times.

SEISMOLOGY AND TECTONICS

REFER ALSO TO CITATION(S) 48486, 49286, 49293, 49426

49290 (NUREG/CR—0875) **Seismicity and tectonic relationships of the Nemaha Uplift in Oklahoma. Part II.** Luza, K.V.; Lawson, J.E. (Oklahoma Univ., Norman (USA)). Jan 1979. 85p. NTIS.

Geologic studies concentrated on completion of structure-contour maps on the top of the Viola Formation, the base of the Pennsylvanian, and the top of the Oswego Formation, and a detailed structure-history study of the Nemaha Uplift in the Oklahoma City area. The seismologic studies can be groupded into two basic categories: seismograph-station installation, maintenance, and operation, and data processing. The statewide seismograph network was completed last year. Seven stations were installed to provide detailed coverage of the Nemaha Ridge as well as of most of Oklahoma. A local earthquake-location program, HYPERCUBE, was developed. It calculates individual and average magnitudes of up to four typs: m3Hz, mbLg, mbeus, and MDUR. A formula for magnitude calculated from duration gives magnitudes consistent iwth Nuttli's m3Hz and mbLg scales. An alternate magnitude scale was needed where data were insufficient to calculate a m3Hz or mbLg magnitude, particularly with small-magnitude earthquake events. A magnitude—duration scale, which uses the equation MDUR = -1.49 + 1.86 log(DUR), is used for local and regional earthquakes. A three-state catalog of earthquakes from January 1, 1977, to September 30, 1978, was printed; approximately 100 earthquakes in Oklahoma, Kansas, Nebraska, and nearby areas were located. In Oklahoma, a seismic trend includes a roughly linear zone extending northeast from the El Reno area and forming a line that crosses the Nemaha Uplift at a 30° angle. In south-central Oklahoma, a concentration of earthquakes occurred near Wilson. In southeastern Oklahoma, several epicenters parallel the northern front of the Ouachita Uplift. 12 figures, 8 tables.

49291 (NUREG/CR—0887) **Crustal subsidence in eastern Maine.** Tyler, D.A.; Ladd, J.; Borns, H.W. (Boston Coll., Weston, MA (USA). Weston Observatory). Jan 1979. 11p. NTIS, PC A02/MF A01.

Comparison of vertical leveling data from the U.S. Coast and Geodetic Survey 1942 and 1966 surveys of the line from Bangor to Calais, Maine, coupled with geological and historical data, indicates that the coastal zone is warping downward towards the east. Between 1942 and 1966 the relative subsidence was up to 175mm. This is a minimum figure. 1 figure, 1 table.

49292 (UCRL—82636) **Regionalization of ground motion attenuation in the conterminous United States.** Chung, D.H.; Bernreuter, D.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 13 Apr 1979. Contract W-7405-ENG-48. 16p. (CONF-790831—1). Dep. NTIS, PC A02/MF A01.

From U.S. National conference on earthquake engineering; Stanford, CA, USA (22 Aug 1979).

Attenuation results from geometric spreading and from absorption. The former is almost independent of crustal geology or physiographic region. The latter depends strongly on crustal geology and the state of the earth's upper mantle. Except for very high-frequency waves, absorption does not affect ground motion at distances less than 25 to 50 km. Thus, in the near-field zone, the attenuation in the eastern United States will be similar to that in the western United States. Most of the differences in ground motion can be accounted for by differences in attenuation caused by differences in absorption. The other important factor is that for some Western earthquakes the fault breaks the earth's surface, resulting in larger ground motion. No Eastern earthquakes are known to have broken the earth's surface by faulting. The stress drop of Eastern earthquakes may be higher than for Western earthquakes of the same seismic moment, which would affect the high-frequency spectral content. This factor is believed to be of much less significance than differences in absorption in explaining the differences in ground motion between the East and the West. 6 figures.

GEOPHYSICAL SURVEY METHODS

REFER ALSO TO CITATION(S) 49085

49293 (LA—7876-MS) **Homomorphic processing of seismic signals.** Brolley, J.E. (Los Alamos Scientific Lab., NM (USA)). Jun 1979. Contract W-7405-ENG-36. 13p. Dep. NTIS, PC A02/MF A01.

An introduction to homomorphic processing of time series is presented. The basic concept is discussed and one form of implementation is adduced. Simple examples of reverberation problems are illustrated. Simple applications to real-time series associated with underground nuclear explosions and earthquakes are then presented. 19 figures.

MINERALOGY, PETROLOGY, AND ROCK MECHANICS

REFER ALSO TO CITATION(S) 48506

49294 (COO—4054-3) **Fluid transport properties of rock fractures at high pressure and temperature. Progress report, July 1, 1978—June 30, 1979.** Engelder, T.; Scholz, C. (Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory). May 1979. Contract EY-76-S-02-4054. 27p. Dep. NTIS, PC A03/MF A01.

Accomplishments during the first 30 months of work on the fluid transport properties of rock fractures at high pressure are discussed in detail in this report and by Kranz et. al in Int. J. Rock Mech. Min. Sci. (1979). The following results are discussed in this report. Fracture permeability is highly sensitive to initial surface roughness. Changes in permeability are found to be proportional to (BdP/sub f/ - adP/sub c/), where b/a < 1. When absolute aperture is used to calculate permeability, permeability measured by the pulse decay is constant between confining pressures of 300 b and 3 kb; this suggests that the cross-sectional area of the joint aperture varies linearly with confining pressure. Increasing pore pressure forces joints open only when the effective pressure across the joint has been reduced to less than 500 b. Dissolution in chemically active fluids affects joint permeability. 9 figures.

49295 **Effect of stress on the petrophysical properties of some sandstones.** Krug, J.A. Golden, CO; Colorado School of Mines (1977). 185p. University Microfilms Order No. 78-02799.

Thesis (Ph. D.).

The petrophysical properties of seventeen sandstones were measured at hydrostatic stresses of 0 to 5000 psig. The measurements included bulk compressibility, porosity, resistivity, permeability, and dynamic mechanical properties. The bulk compressibility was measured using three different techniques: fluid extruded, strain, and dynamic. The fluid extruded and strain techniques are considered static measurements and were found to be about five times larger than the dynamic bulk compressibility. The resistivity was found to increase with an increase in confining pressure. The relative change in formation factor was shown to be related to the change in the internal surface area-per-unit-pore volume and in turn related to (λ + 2G). The permeability was found to decrease with an increase in confining pressure. Permeability was also shown to be related to (λ + 2G).

49296 **Interpretation of induced polarization and resisitivity data.** Pelton, W.H. Salt Lake City, UT; Univ. of Utah (1977). 272p. University Microfilms Order No. 77-18,154.

Thesis (Ph. D.).

Complex resistivity and dielectric data may be interpreted quite simply in terms of relaxations. Ridge regression inversion was used to fit various simple relaxation models to complex resistivity measurements of mineralized and clay-bearing terrestrial rocks, and to dielectric measurements of returned lunar samples. Of all the relaxation models which have been considered, the Cole—Cole model was found to provide the simplest, yet most accurate, representation of the complex resistivity behavior of mineralized rocks. The main variation in model parameters with different types of mineralization occurs in the chargeability, and particularly in the time constant, of the relaxation. Graphite, pyrrhotite, and wet porphyry deposits are associated with large time constants whereas volcanogenic massive sulfides, magnetite and dry porphyry deposits are associated with small time constants. Since studies of the impedance of the mineral—electrolyte interface reveal relatively small variations with mineral type, the differences in time constant and chargeability appear mainly due to characteristic differences in mineral texture rather than differences in composition. Measurements over mineral deposits of limited size result in apparent complex resistivity spectra which are different from the true spectra; however, the relaxation parameters describing apparent spectra may be predicted from the true relaxation parameters and from the same dilution factor used to obtain apparent polarizability from true polarizability. Calculation of the dilution factor is straightforward only if the geometry and resistivity of the source is known. A simple program, developed to invert apparent resistivity and polarizability pseudosections, provides this information and is discussed.

GEOCHEMISTRY

REFER ALSO TO CITATION(S) 49171

49297 (NVO—0703-1, pp 17) **Hydrogeochemistry of Enewetak Atoll.** Buddemeier, R.W. (Univ of Hawaii, Honolulu). Feb 1979. In Mid-Pacific Marine Laboratory. Annual report, 1 July 1976—30 September 1977.

During the past year of this continuing study most of the measurements of tidal response characteristics of the groundwater wells on Enjebi, Runit, Japtan, and Medren have been completed. Characterization of the quantity and quality of the groundwater has been extended by in situ probing and by laboratory analysis. Rainfall data collection has been continued. Tritium studies of the groundwater have been expanded and a model of the hydrologic system and the groundwater geochemistry is being developed.

PHYSICS RESEARCH

REFER ALSO TO CITATION(S) 48749

ASTROPHYSICS AND COSMOLOGY

COSMIC RADIATION

REFER ALSO TO CITATION(S) 49300

49298 (LA-UR—79-1582) **Predicted versus observed cosmic-ray-produced noble gases in lunar samples: improved Kr production ratios.** Regnier, S.; Hohenberg, C.M.; Marti, K.; Reedy, R.C. (California Univ., San Diego, La Jolla (USA); Washington Univ., St. Louis, MO (USA); Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 36p. (CONF-790381—2). Dep. NTIS, PC A03/MF A01.

From 10. lunar and planetary science conference; Houston, TX, USA (19 Mar 1979).

New sets of cross sections for the production of krypton isotopes from targets of Rb, Sr, Y, and Zr were constructed primarily on the bases of experimental excitation functions for Kr production from Y. These cross sections were used to calculate galactic-cosmic-ray and solar-proton production rates for Kr isotopes in the moon. Spallation Kr data obtained from ilmenite separates of rocks 10017 and 10047 are reported. Production rates and isotopic ratios for cosmogenic Kr observed in ten well-documented lunar samples and in ilmenite separates and bulk samples from several lunar rocks with long but unknown irradiation histories were compared with predicted rates and ratios. The agreements were generally quite good. Erosion of rock surfaces affected rates or ratios for only near-surface samples, where solar-proton production is important. There were considerable spreads in predicted-to-observed production rates of ^{83}Kr, due at least in part to uncertainties in chemical abundances. The ^{78}Kr/^{83}Kr ratios were predicted quite well for samples with a wide range of Zr/Sr abundance ratios. The calculated ^{80}Kr/^{83}Kr ratios were greater than the observed ratios when production by the ^{79}Br(n,γ) reaction was included, but were slightly undercalculated if the Br reaction was omitted; these results suggest that Br(n,γ)-produced Kr is not retained well by lunar rocks. The productions of ^{81}Kr and ^{82}Kr were overcalculated by approximately 10% relative to ^{83}Kr. Predicted-to-observed ^{84}Kr/^{83} ratios scattered considerably, possibly because of uncertainties in corrections for trapped and fission components and in cross sections for ^{84}Kr production. Most predicted ^{84}Kr and ^{86}Kr production rates were lower than observed. Shielding depths of several Apollo 11 rocks were determined from the measured ^{78}Kr/^{83}Kr ratios of ilmenite separates. 4 figures, 5 tables.

49299 **Cosmic rays and particle physics, 1978.** Gaisser, T.K. (ed.). New York, NY; American Institute of Physics (1979). 525p. (CONF-7810116—).

From Bartol conference on cosmic rays and particle physics above 10 TeV; Newark, DE, USA (16 Oct 1978).

Individual items were abstracted separately for the data base.

STARS

49300 (PPPL—1558) **Plasma physics of trapping of cosmic rays around supernova.** Kulsrud, R.M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jun 1979. Contract EY-76-C-02-3073. 10p. (CONF-790836—1). Dep. NTIS, PC A02/MF A01.

From 16. international cosmic rays conference; Kyoto, Japan (6 Aug 1979).

Two problems associated with the question of whether a large number of cosmic rays produced in the early stages of expansion of a supernova bubble would be trapped in it are discussed.

SOLAR PHENOMENA

49301 (AD-A—061454) **The latitudinal structure of solar wind streams from radio scintillation observations.** Kaufman, J.J. (California Univ., San Diego, La Jolla (USA). Dept. of Applied Physics and Information Science). 2 Jun 1978. Contract F19628-77-C-0161. 20p. NTIS PC A02/MF A01.

The relation between the solar corona and high-speed solar wind, measured from interplanetary scintillations (IPS), was investigated. Preliminary results show that regions of high coronal intensity of the 5303 A Fe XIV green line are associated with low IPS velocities, whereas regions of low intensity are associated with both low and high velocities. There is some indication at high heliographic latitudes that the IPS velocity is inversely correlated with the angular divergence of the coronal magnetic field. We present a new model for the turbulence profile in a solar wind stream, which will be used to refine our interpretation of IPS data.

PLANETARY PHENOMENA

REFER ALSO TO CITATION(S) 49298

49302 (CONF-790381—1) **Regolith layering processes based on studies of low-temperature volatile elements in Apollo core samples.** Jovanovic, S.; Reed, G.W. Jr. (Argonne National Lab., IL (USA)). 1979. Contract W-31-109-ENG-38. 30p. Dep. NTIS, PC A03/MF A01.

From 10. lunar and planetary science conference; Houston, TX, USA (19 Mar 1979).

The concentrations of Hg released at $\leq$ 130°C in stepwise heating experiments on core samples from near the lunar surface increase with depth. This is in response to heating of the surface during the lunar day. The steepness of the slopes and the depths to which the gradients extend are determined by the color, density and possibly the grain size of the soils. Earlier surface layers can be identified and, in general, are in agreement with other indicators of such layers. Low temperature volatilized Br exhibits trends that parallel those of Hg in a number of cases. This is also true of fractions released at higher temperatures. The coherence, especially in high temperature fractions, between these chemically dissimilar elements implies a common physical process of entrapment; possibly one related to the presence of vapor deposits on surfaces and to opening and closing of microcracks and pores.

ATMOSPHERIC PHYSICS

AURORAL AND IONOSPHERIC PHENOMENA

49303 (AD-A—060955) **Nonlinear stabilization of the ExB gradient drift instability in ionospheric plasma clouds. Interim report.** Chaturvedi, P.K.; Ossakow, S.L. (Naval Research Lab., Washington, DC (USA)). Oct 1978. 37p. NTIS PC A03/MF A01.

The authors present a two-dimensional nonlinear stabilization mechanism for the ExB instability occurring in striated F region ionospheric plasma clouds. A simple model shows that the saturated power spectrum for striations proportional to $1/k^2$. Comparisons with experimental data from DNA-sponsored STRESS barium cloud experiments and the results of numerical simulations are given.

49304 (AD-A—061042) **Origin of the auroral electric field. Final report, September 1976-September 1977.** Kan, J.R.; Akasofu, S.I. (Alaska Univ., College (USA). Geophysical Inst.). Dec 1977. Contract F19628-77-C-0038. 32p. NTIS PC A03/MF A01.

A theory is presented to show that a pair of electric fields directed towards each other and perpendicular to the current sheet is inherent to electron current sheets in dynamic equilibrium. The theory predicts self-consistently the magnitude of the electric field and the width of the current sheet for a given current density and the ion and electron energy densities. It is also shown that the potential difference associated with the inherent electric fields is on the order of the ion thermal energy and that this potential difference must be distributed almost entirely along field lines between the plasma sheet and the ionosphere as a result of closing the auroral sheet current through the ionosphere. Thus, one can make a few important observable predictions, such as the relationship between the width and the brightness of an auroral arc, and the average energy of auroral electrons as a function of latitutdes. These predictions are qualitatively supported by observations.

49305 (AD-A—061088) **Steady-state multi-ion disturbed D-region model. Environmental research papers.** Swider, W.; Foley, C.I. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 15 Jun 1978. 45p. NTIS PC A03/MF A01.

A model with 78 reactions involving 21 positive ions and 8 negative ions has been developed for the disturbed D-region under steady-state conditions. Model examples are given for the 2 to 5 November 1969 and 3 to 11 August 1972 solar proton events. The computer program for the model is given in the appendix.

49306 (AD-A—061261) **Nonlinear equatorial spread F: dependence on altitude of the F peak and bottomside background electron density gradient scale length. Interim report.** Ossakow, S.L.; Zalesak,

S.T.; McDonald, B.E.; Chaturvedi, P.K. (Naval Research Lab., Washington, DC (USA)). Apr 1978. 65p. NTIS PC A04/MF A01.

Four different two dimensional (perpendicular to the ambient magnetic field), plasma fluid-type, numerical simulations following the nonlinear evolution of the collisional Rayleigh-Taylor instability in the nighttime equatorial F region ionosphere have been performed. Realistic altitude dependent ion-neutral collision frequencies, recombination rates, and ambient electron density profiles were used. In three cases (ESF 0, 1, 3) the electron density profile was kept constant, with a minimum bottomside background electron density gradient scale length L about 10 km, but the altitude of the F peak was changed, with F peak altitudes at 340, 350, and 430 km. All cases resulted in bottomside growth of the instability (Spread F) with dramatically different time scales for development. Plasma density depletions were produced on the bottomside with rise velocities, produced by nonlinear polarization E x B forces, of 2.5, 12, and 160 m/sec, and percentage depletions of 16, 40, and 85, respectively. High altitude of the F peak, small bottomside electron density gradient scale lengths, and large percentage depletions yield large vertical bubble rise velocities, with the first two conditions favoring bottomside linear growth of the instability. The numerical simulation results are in good agreement with rocket and satellite in situ measurements and radar backscatter measurements, including some of the recent results from the August 1977 coordinated ground based measurement campaign conducted by DNA at Kwajalein.

49307 (AD-A—061343) **Zonal winds as a generating mechanism for the ionospheric irregularities that cause equatorial scintillation of satellite signals. Research and development report, January-June 1978.** Paulson, M.R. (California Univ., Davis (USA). Dept. of Land, Air, and Water Resources). 26 Jun 1978. 32p. NTIS PC A03/MF A01.

The theory that thermospheric zonal winds generate the ionospheric irregularities that cause scintillation is examined. Good correlation between diffraction pattern drift velocities and scintillation intensities tends to support the theory, but night-to-night variation in this relationship suggests that other factors may be operative. Additional measurements are recommended.

49308 (AD-A—061362) **A fluid model for estimating minimum scale sizes in ionospheric plasma cloud striations. Memorandum report.** McDonald, B.E.; Ossakow, S.L.; Zalesak, S.T.; Zabusky, N.J. (Naval Research Lab., Washington, DC (USA)). 30 Oct 1978. 44p. NTIS PC A03/MF A01.

We propose a fluid model for investigating the possibility that a small scale cut-off is present in plasma cloud striations due to particle diffusion. The model is two dimensional and perpendicular to the magnetic field, and assumes parameters applicable to the F region. The non-dimensionalized equations for the model show that the plasma motion is determined by initial plasma distribution and the value of an effective Reynolds number. Numerical simulations carried out for random phase initial conditions and maximum to minimum Pedersen conductivity ratio of 11 to 1 suggest that striation formation stops when the Reynolds number drops below about 400. We calculate a diffusion constant including electron-ion collisions, which can be dominant in high altitude releases. We then scale the results of the numerical simulation and conclude that the fluid model (without kinetic corrections) predicts a minimum scale size in the range 2.4-24 m for a typical choice of ionospheric parameters. These minimum scale sizes are in agreement with project STRESS rocket in situ measurements.

49309 (AD-A—061570) **Effects of strong local sporadic E on elf propagation. Interim report, 1 February-1 June 1978.** Pappert, R.A.; Shockey, L.R. (California Univ., Davis (USA). Dept. of Land, Air, and Water Resources). 15 Aug 1978. 43p. NTIS PC A03/MF A01.

A simple Kirchhoff-Huygens diffraction model has been used to estimate the effect of a patch of sporadic E on propagation in the lower ELF band. The patch is approximated by a lumped parameter phase-amplitude screen allowed to move along a great circle path normal to the transmitter-receiver great circle path. The results indicate that sporadic E patches on the order of 1000 x 1000 km, causing phase rate shifts and attenuation rate enhancements consistent with full wave modal evaluations, can account for the 6-8 dB fades observed in connection with 1600 km Wisconsin Test Facility (WTF) transmissions. The results suggest also that such disturbances can be expected to produce 2 to 4 dB fades over paths as long as 10,000 km.

49310 (AD-A—061619) **Modeling the ion chemistry of the D region: a case study based upon the 1966 total solar eclipse. Research and development technical report.** Heaps, M.G.; Niles, F.E.; Sears, R.D. (Army Electronics Command, White Sands Missile Range, NM (USA). Atmospheric Sciences Lab.). Sep 1978. 54p. NTIS PC A04/MF A01.

The 12 November 1966 solar eclipse has been modeled by a large multi-species chemistry code were and the results compared with the numerous experimental measurements which were made at that time. Good agreement between measured preeclipse values of electron density and code-predicted values is obtained when ionization by precipitating electrons from the radiation belts is included. The current gas-phase ion chemistry does not predict the rapid decrease and subsequent reconstitution of the electron density about totality in the 65 to 85 km region, nor does it produce the large amounts of negative ions about 70 km which can be inferred from the experimental data. While basic constraints can be placed on the electron attachment processes because of the experimental data, an entirely new class of physical processes may possibly need to be included to explain this phase of D-region behavior. Comparison with experimental data provides a means of validating the basic atmospheric modeling computer codes which are used as input for Army communication systems and in the Army nuclear weapons effect community.

49311 (AD-A—061910) **Estimating the spectrum of electron density fluctuations from simulations of ionospheric plasma clouds. Interim report.** Zabusky, N.J.; Block, J. (Naval Research Lab., Washington, DC (USA)). Jul 1978. 69p. NTIS PC A04/MF A01.

Numerical simulations of ionospheric plasma clouds yield information for four related purposes: to interpret past barium cloud experiments; to predict phenomena in new experiments; to validate algorithms used in system codes which determine the life-time of sky regions occluded by striations following a nuclear explosion; and to predict the temporal evolution of the spectrum of electron-density fluctuations (EDF's) for use in propagation studies. In this memorandum the spectra of simple geometric figures that have shapes similar to those that arise in the evolution of ionospheric plasma clouds are studied.

EFFECTS OF NUCLEAR DETONATIONS

REFER ALSO TO CITATION(S) 49311

49312 (AD-A—061430) **Requirements for improved infrared prediction capability. HAES report number 78. Final report, 4 May 1977—30 Apr 1978.** Archer, D.H. (Mission Research Corp., Santa Barbara, CA (USA)). 30 Apr 1978. Contract DNA001-77-C-0227. 98p. NTIS PC A05/MF A01.

This report describes work performed to determine the major uncertainties involved in the prediction of infrared radiation in the 2- to 5-micrometers region following atmospheric nuclear bursts. Emphasis is placed on wavelength bands near 2.8 and 4.3 micrometers. Specifically included for consideration are the molecular species NO, CO_2, CO, OH, HO_2, H_2O, H_2O_2, HNO_2, HNO_3, $N_{14}N_{15}$, NO(+), and N_2O. A priority listing is provided of recommended research items necessary for improvement of our prediction capability.

MAGNETOSPHERIC PHENOMENA

49313 (LA-UR—79-1660) **Real-time ISEE data system.** Tsurutani, B.T.; Baker, D.N. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 13p. (CONF-790413—4). Dep. NTIS, PC A02/MF A01.

From International solar-terrestrial predictions workshop; Boulder, CO, USA (23 Apr 1979).

Prediction of geomagnetic substorms and storms would be of great scientific and commercial interest. A real-time ISEE data system directed toward this purpose is discussed in detail. Such a system may allow up to 60+ minutes advance warning of magnetospheric substorms and up to 30 minute warnings of geomagnetic storms (and other disturbances) induced by high-speed streams and solar flares. The proposed system utilizes existing capabilities of several agencies (NASA, NOAA, USAF), and thereby minimizes costs. This same concept may be applicable to data from other spacecraft, and other NASA centers; thus, each individual experimenter can receive quick-look data in real time at his or her base institution. 6 figures, 1 table.

ATOMIC, MOLECULAR, AND CHEMICAL PHYSICS

BEAMS AND THEIR REACTIONS

REFER ALSO TO CITATION(S) 49353, 49406

49314 (LBL—9219) **Photodissociation processes in molecular beams.** Carlson, L.R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; California Univ., Berkeley (USA). Dept. of Chemistry). May 1979. Contract W-7405-ENG-48. 145p. Dep. NTIS, PC A07/MF A01.

Thesis.

A description is presented of a study of the photodissociation dynamics of molecules in a molecular beam. Photo-fragmentation translational spectroscopy has been utilized to observe the photodissociation dynamics of ozone. Using a supersonic molecular beam and

a 10 nanosecond pulsed laser at $\lambda = 266$ nm, the velocities of the fragment products are measured by the method of time of flight. The resolution of the time of flight spectrum of ozone is sufficiently high that the electronic and vibrational states are clearly resolved and identified. Above the threshold ($\lambda < 310$ nm), the quantum yield for the production of $O(^1D)$ has been estimated in the past to be unity for the process $O_3(^1A_1) + h\nu)\lambda < 300$ nm) $\rightarrow O_3(^1B_2) \rightarrow O_2(^1\Delta/$ sub g/) + $O(^1D)$. However a small production of O_2 ($^3\Sigma$/sub g/$^-$) + $O(^3P)$ has been observed in this study. The $O_2(^1\Delta$/sub g/) product yields four vibrational states (v = 0, 1, 2, 3) which yields a vibrational temperature of 2700°K along with narrow energy distributions of rotational levels. These energy distributions are compared with photodissociation models along with the polarization dependence of the dissociative process which was also measured. 143 references.

49315 (UCRL—82889) **Formation of hydrogen negative ions by surface and volume processes with application to negative ion sources.** Hiskes, J.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 Jun 1979. Contract W-7405-ENG-48. 21p. (CONF-790708—3). Dep. NTIS, PC A02/MF A01.

From XIV conference internationale sur les phenomenes d'ionisation dans les gaz; Grenoble, France (9 Jul 1979).

During the last few decades interest in negative-hydrogen ion sources has been directed mainly toward synchrotron and other particle accelerator applications, with emphasis on high current densities delivered for short pulses. But within the last several years there has been an awareness in the magnetic fusion program of the future need for negative ions as a means for generating high energy neutral beams, beams with energies above a few hundred keV. Negative ions seem to be the only effective intermediary for efficiently producing such beams. Although methods for generating negative ion beams have relied upon synchrotron concepts, the requirements for fusion are very different: here one is interested in more moderate current densities, up to 100 m A cm^{-2}, but with continuous operation. Proposed source modules would accelerate of the order of 10 A of beam current and deliver several megawatts of beam power. Both H^- and D^- beams are being considered for application in different reactor systems. The conceptualization of negative ion sources is now in a very volatile stage. But of the great variety of proposals that have been offered to date, three general areas appear ready for development. These are: first, the double charge exchange method for converting a positive ion beam into a negative ion beam; second, electron-volume processes wherein low energy electrons interacting with molecular species lead to negative ion products via dissociative attachment or recombination; and third, generation of negative ions in surface interactions, principally via desorption and backscattering. Both our qualitative and our quantitative understanding of these processes diminishes as one proceeds from the first through the third. The physics of these three methods is considered in detail.

ATOMIC AND MOLECULAR PROPERTIES

49316 (AD-A—060954) **Stark profile calculations for Lyman series lines of one-electron ions in dense plasmas. Interim report.** Kepple, P.C.; Griem, H.R. (Naval Research Lab., Washington, DC (USA)). Sep 1978. 132p. NTIS PC A07/MF A01.

The frequency distributions of the first six Lyman lines of hydrogen-like carbon, oxygen, neon, magnesium, aluminum, and silicon ions broadened by the local fields of both ions and electrons are calculated for dense plasmas. The electron collisions are treated by an impact theory allowing (approximately) for level splittings caused by the ion fields, finite duration of the collisions, and screening of the electron fields. Ion effects are calculated in the quasistatic, linear Stark-effect approximation, using distribution functions of Hooper and Tighe which include correlation and shielding effects. Theoretical uncertainties from the various approximations are estimated, and the scaling of the profiles with density, temperature and nuclear charge is discussed. A correction for the effects caused by low frequency field fluctuations is suggested.

49317 (COO—4264-2) **Oscillator strengths for highly ionized atomic systems. Progress report, May 1, 1977—April 30, 1978.** Fischer, C.F. (Pennsylvania State Univ., University Park (USA)). Jan 1978. Contract EG-77-S-02-4264. 16p. Dep. NTIS, PC A02/MF A01.

A general program for multi-configuration Hartree—Fock calculations (MCHF77) and a technical report describing the use of the program were prepared. The program will be available for distribution. Several f-value trends were studied using the MCHF approach: (1) $4s^2\ ^1S$ - $4s\ 4p\ ^1P$ Transitions in the Zn Sequence. The effect of core polarization from the $3d^{10}$ shell was included in the calculation and relativistic effects estimated. The former decreases with increasng nuclear charge and does not account for the discrepancy of almost a factor two in theoretical and observed f-values for Kr VII. The present f-values are the most accurate theoretical ones determined to date. (2) $3s^2\ 4s\ ^2S$ - $3s^2\ 4p\ ^2P$ Transition in the Al Sequence. The incomplete n = 3 subshell in the core introduces both correlation in and with the core reducing the f-value even at high Z. At the same time cross-overs of configurations occur, but only some cause irregularities in the f-value trends. (3) $[3p^2, 3s\ 3d]^1D$ - $\{3p\ 3d, 3s\ 4f\}^1F$ and $3s\ 3d\ ^3D$ - $\{3p\ 3d, 3s\ 4f\}^3F$ Transitions in the Mg Sequence. Accurate f-values were determined. Few experimental values are available, but generally good agreement is observed. Correlation and spin-orbit interaction were combined in an energy level calculation for $Ar^{+2}\ 2p^5\ 3p^5$. When radial functions for an average configuration are used, interaction with configurations differing by a single electron reduced the spread in the levels. Cowan achieves a similar result by multiplying all Slater integrals by a factor between 0.80—0.90. A list of publications is included.

49318 (COO—4264-4) **Energy levels and gf-values for Fe XIV.** Fischer, C.F. (Pennsylvania State Univ., University Park (USA). Dept. of Computer Science). Dec 1978. Contract EG-77-S-02-4264. 24p. Dep. NTIS, PC A02/MF A01.

In order to check whether a line in the 91 A region could be due to some other transition, calculations were performed for the odd and even states of the n = 3 complex. From these wave functions, gf-values were computed for all dipole transitions between states in the two groups. No line with a significant gf value was found in the region of 91 A. 9 references (JFP)

49319 (COO—4264-5) **Oscillator strengths for highly ionized atomic systems.** Fischer, C.F. (Pennsylvania State Univ., University Park (USA)). Jan 1979. Contract EG-77-S-02-4264. 12p. Dep. NTIS, PC A02/MF A01.

Evidence has been found recently that the cascade process may be more important in the analysis of beam-foil decay curves than anticipated. In order to assist the analysis of such data the multiconfiguration Hartree—Fock program (MCHF77) has been applied to the theoretical study of several transitions which are part of a cascade process for resonance transitions $\{3p^2, 3s\ 3d\}^1D$ - $\{3p\ 3d, 3s\ 4f\}^1F$ and $\{3s\ 3d\}^3D$ - $\{3p\ 3d, 3s\ 4f\}^3F$ in the Mg sequence. For higher members of the sequence, MCHF77 was modified to include the relativistic effects which shift the energy of a configuration as a whole, and intermediate coupling calculations were performed. The $4s\ 4p\ ^1P$ - $\{4p^2, 4s\ 4d\}^1D$ transitions in the Zn I sequence were also examined. A strong interaction exists between $4p^2$ and $4s\ 4d\ ^1D$ and it has been shown that much of the earlier experimental material concerning the ^1D terms are in error. Comparison with a few recent experimental investigations shows good agreement. Relatively few levels have been identified in Fe XIV. Because of the importance of the iron ions both in astrophysics and tokamak plasma research, a line list has been produced for levels with three electrons in the M shell. gf-values for allowed transitions and intercombination lines are tabulated. A list of publications is included.

49320 (LBL—9082) **Lifetime of the metastable 2^3S_1 state in stored Li^+ ions.** Knight, R.D. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Apr 1979. Contract W-7405-ENG-48. 143p. Dep. NTIS, PC A07/MF A01.

Thesis.

A laser-induced fluorescence technique combined with the observation of spontaneous magnetic dipole photons from the highly metastable 2^3S_1 state of Li^+ was used to measure the radiative lifetime of this state. The ions are created by electron impact on a lithium atomic beam and are subsequently stored for periods of many seconds in an RF-quadrupole ion trap. A tunable dye laser excites the 2^3S—2^3P, transition at 5485A, and the intercombination electric dipole transition 2^3P_1—$1\ ^1S_0$ at 202A is observed. This process depletes the metastable population in a time tau/sub d/ < 1 sec < < tau/sub $^3S_1$/ and provides a measure of the total number of metastables. Comparison with the rate of 210A spontaneously emitted photons yields a measured value for the 2^3S_1 radiative lifetime of tau/sub rad/ = 58.6 +- 12.9 sec, where the quoted error represents 95% confidence levels. The theoretical lifetime is tau/sub theory/ = 49.0 sec. The measured value includes data taken with both $^6Li^+$ and $^7Li^+$ isotopes and was corrected for the slightly different detector efficiencies at 202A and 210A. A careful study of nonradiative quenching of the metastable state was necessary to understand observed differences between tau/sub rad/ and tau/sub $^3S_1$/, the total metastable lifetime. Spatial density profiles of the ions within the trap, useful for determining the ion temperature, were obtained by scanning the laser beam horizontally across the ion trap while storing 2^3P_1—$^1S_0$ photon counts as a function of the laser beam's position. Agreement with a simple equilibrium model, including space charge effects, is satisfactory. A study of the optical pumping process is necessary to understand the laser-ion interaction, and observational and theoretical data are presented. 47 references.

49321 **Statistic and comparable measures in linear free-energy relationship fittings.** Ehrenson, S. (Brookhaven National Lab., Upton, NY). *J. Org. Chem.;* **44**: No. 11, 1793-1797(25 May 1979).

The properties and validity of a goodness-of-fit statistic, f, previously employed in dual-substituent linear free-energy equation

fittings are carefully examined and verified. Confidence level tables are presented for f ratio comparisons and examples given for their use. These confidence level measures constitute an original (for linear free-energy applications) means of judging whether one system of parametrization ultimately based upon experimental observation is significantly (statistically) better than another similarly derived in given correlation applications. Brief analysis of relationships to other currently favored measures, most of which are not directly comparative, is presented. The value and means of testing independence among multiple variable sets are also given brief scrutiny. 2 figures, 3 table.

POSITRONIUM, MUONIUM, AND MUONIC AND MESIC ATOMS AND MOLECULES

REFER ALSO TO CITATION(S) 49330

49322 (CALT—63-304) **Capture of muons in atoms.** Vogel, P. (California Inst. of Tech., Pasadena (USA)). 1978. Contract EY-76-C-03-0063. 34p. (CONF-7804144—1). Dep. NTIS, PC A03/MF A01.

From Nordic spring symposium on inner shell phenomena; Geilo, Norway (17 Apr 1978).

A lecture is given on the general theoretical framework developed for the description of the formation of mesic atom and the initial part of the atomic cascade. Some of the observable phenomena are also discussed. 16 references. (JFP)

COLLISION PHENOMENA

REFER ALSO TO CITATION(S) 49315

49323 (AD-A—061099) **Theoretical studies relating to the interaction of radiation with matter: atomic collision processes occurring in the presence of radiation fields. Annual report No. 1, 1 August 1977—31 July 1978.** Berman, P.R.; Robinson, E.J. (New York Univ., NY (USA). Dept. of Physics). 1 Oct 1978. Contract N00014-77-C-0553. 134p. NTIS PC A07/MF A01.

the following topics were investigated: Collisional studies using laser spectroscopy; The nature and validity of collision kernels; Strong field effects in laser spectroscopy; Optical collisions including a model potential calculation; Radiative collisions including model potential calculations; Laser assisted heating or cooling; and Collisional studies using photon echoes or Optical Ramsey Fringes.

49324 (AD-A—061370) **Anual summary of O.N.R. contract number N00014-76-C-0014. Summary report, February 1978-February 1979.** Mittleman, M.H. (City Coll., New York (USA)). 15 Nov 1978. Contract N00014-76-C-0014. 9p. NTIS PC A02/MF A01.

The following topics were investigated: Configuration space Hamiltonian for Heavy Atoms; Laser-Atom Interactions; Electron-Atom Scattering in the presence of a laser field, for resonant laser frequency and for low laser frequency; Resonance Fluorescence; and Statistical Model of Atom-Atom Scattering.

49325 (AD-A—061534) **Structure of multiply ionized heavy ions and associated collision phenomena. Status report, November 1977—October 1978.** Sellin, I.A. (Tennessee Univ., Knoxville (USA)). Oct 1978. Contract N00014-75-C-0474. 18p. NTIS PC A02/MF A01.

Experiments on ion-atom and ion-molecule collisions using highly ionized projectiles are proposed. Electron ejection by these projectiles and decay of excited states of these ions by x-ray and also by electron emission processes are the processes most commonly observed in carrying out these experiments.

49326 (CONF-790524—8) **Interactions of fast molecular ions with matter.** Gemmell, D.S. (Argonne National Lab., IL (USA)). 1979. Contract W-31-109-ENG-38. 15p. Dep. NTIS, PC A02/MF A01.

From 6. international congress symposium on radiation research and stem cells; Tokyo, Japan (13 May 1979).

There are many interesting aspects of the interactions of fast ions with matter that can be explored using molecular-ion projectiles. At high velocities, these projectiles dissociate rapidly ($\sim 10^{-17}$ sec) upon entering a solid. Each projectile then results in a tight cluster of fragments which continue into the solid closely correlated in space and in time. Recent high-resolution studies on the trajectories of such fragments, their energy losses, their shifts in angle and energy, their charge states, etc., have produced a wealth of new information on such phenomena as stopping power, radiation damage, and the interactions of fast ions with the plasma oscillations they induce in solids. Studies with foil and gas targets have elucidated many aspects of the differences in interactions in solids and gases. The techniques used in these experiments show promise as a tool for studying molecular-ion structures.

49327 (COO—4971-1) **Energy-related atomic and molecular structure and scattering studies. Annual progress report, July 1, 1978—June 30, 1979.** Bederson, B. (New York Univ., NY (USA). Dept. of Physics). Mar 1979. Contract ER-78-S-02-4971. 17p. Dep. NTIS, PC A02/MF A01.

A program was initiated to measure the electric dipole polarizabilities, higher energy moments and cross sections for the scattering of low energy electrons by alkali halide molecules, their dimers and larger clusters. Preparatory work is also being carried out to perform similar measurements on the important atomic species, N, O, C and S. This report presents some preliminary data of the measurements of the polarizabilities of $(CsCl)_2$, $(RbCl)_2$ and $(KCl)_2$. A description is contained of a new scattering apparatus now under construction that will enable scattering experiments with high energy (< 0.80 eV) and angular ($< 1^0$) resolution, with state preparation and analysis.

49328 **Molecular photoelectron spectroscopy.** Eland, J.H.D. (Argonne National Lab., IL (USA)). *J. Phys., E (London);* **11**: No. 10, 969-977(Oct 1978).

Photoelectron spectroscopy is the spectroscopy of molecular positive ions and of electron orbitals in molecules, metals and surfaces. In the last decade this technique has caused a revolution in our understanding of ionisation and ion behaviour. It has now passed from the pioneering stage to the status of a well established chemical and physical technique, and basic research into molecular ion physics or the photoionisation process calls for more complex instrumentation and data-handling methods than hitherto.

ATOMIC AND MOLECULAR THEORY

49329 (CONF-790538—13) **Molecular dynamics studies of superionic conductors.** Rahman, A. (Argonne National Lab., IL (USA)). 1979. Contract W-31-109-ENG-38. 9p. Dep. NTIS, PC A02/MF A01.

From Fast ion transport in solids-electrode and electrolytes conference; Lake Geneva, WI, USA (21 May 1979).

Over the last fifteen years computer modeling of liquids and solids has become a useful method of understanding the structural and dynamical correlations in these systems. Some characteristics of the method are presented with an example from work on homogeneous nucleation in monoatomic liquids; the interaction potential determines the structure: a Lennard—Jones system nucleates a close packed structure while an alkali metal potential nucleates a bcc packing. In the study of ionic systems like CaF_2 the Coulomb interaction together with the short range repulsion is enough to produce a satisfactory model for the motion of F^- ions in CaF_2 at $\sim$ 1600°K. Analysis of this motion shows that F^- ions reside at their fluorite sites for about 6×10^{-12} s and that the diffusion is mainly due to F^- jumps in the 100 direction. The motion can be analyzed in terms of the generation and annihilation of anti-Frenkel pairs. The temperature dependence of the F^- diffusion constant at two different densities has also been calculated. The computer model does not correspond with experiment in this regard.

49330 (COO—4264-3) **Multiconfiguration Hartree—Fock method for atomic energy levels and transition probabilities.** Fischer, C.F. (Pennsylvania State Univ., University Park (USA)). 1978. Contract EG-77-S-02-4264. 17p. (CONF-7808110—1). Dep. NTIS, PC A02/MF A01.

From 6. international conference on atomic physics; Riga, USSR (17 Aug 1978).

The effect of correlation in the motion of electrons in a many-electron system is considered in the theoretical determination of atomic properties. The correlation effects are computed using the configuration interaction. Restriction is made to the discussion of outer processes of neutral atoms or ions of low degree of ionization in which the relativistic effects are small. The first-order theory, the 3p,3d state of Al II, correlation in the 3d/sup n/ shell, and f-values in the presence of cross-overs are discussed. 29 references. (JFP)

FLUID PHYSICS

REFER ALSO TO CITATION(S) 49427

GENERAL FLUID DYNAMICS

49331 (LBL—8946) **Experimental study of combustion in a turbulent boundary layer.** Cheng, R.K.; Bill, R.G. Jr.; Robben, F.; Schefer, R.; Talbot, L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 1979. Contract W-7405-ENG-48. 10p. (CONF-790721—1). Dep. NTIS, PC A02/MF A01.

From 2. symposium on turbulent shear flows; London, UK (2 Jul 1979).

The effect of H_2—Air combustion on induced turbulence in a heated boundary layer has been studied through time and space resolved measurements of velocity (laser Doppler anemometry) and

density (Rayleigh scattering). From these measurements mean, rms fluctuations, probability density functions and auto-correlations were obtained by digital processing. The experimental conditions covered equivalence ratio from 0 to 0.3, wall temperature between 1100 to 1300°K and free stream velocity from 14 to 22 m/sec. A typical Reynolds number based on the free stream velocity was 3 x 10^5. Three modes of combustion were indicated: (1) surface reaction, (2) surface reaction combined with gas phase reaction in the boundary layer, (3) flame-like structure situated at the edge of the boundary layer. Velocity fluctuations of about 4% in the non-heated boundary layer were reduced to 2% by wall heating. Density fluctuations of 8 to 10% were observed in the heated boundary layer both with and without combustion. The maximum density gradient region of the flame-like structure was found to fluctuate at a fairly regular rate of 0.5 to 1.25 Khz depending on various conditions.

49332 (SAND—79-8679) **Calculation of plane sudden expansion flow via vortex dynamics.** Ashurst, W.T. (Sandia Labs., Livermore, CA (USA)). Jul 1979. Contract EY-76-C-04-0789. 14p. (CONF-790721—2). Dep. NTIS, PC A02/MF A01.

From 2. symposium on turbulent shear flows; London, UK (2 Jul 1979).

The method of discrete vortex dynamics has reproduced the flow that occurs in symmetric channels that have sudden expansions. The calculated lengths of the two recirculation regions agree with experimental data. The flow over a single backward facing step was also calculated. Detailed comparison with experimental results indicates that the calculated turbulent shear stress depends upon the inlet shear layer thickness. A calculational shear layer with the experimental thickness results in a recirculation length longer than the experimental value. This is caused by less entrainment across the separated shear layer. The lack of spanwise fluctuations (stream-wise vorticity components) is the cause of reduced entrainment in the two-dimensional calculation when compared to two-dimensional flow experiments. This current work and the previous study of the free mixing layer show the ability of the discrete vortex dynamic method to simulate turbulent flows. 14 references.

49333 (UCRL—82801) **Vessel discharge by friction dominated tube flow.** Landram, C.S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jun 1979. Contract W-7405-ENG-48. 16p. (CONF-790583—1). Dep. NTIS, PC A02/MF A01.

From Gas dynamics conference; Livermore, CA, USA (22 May 1979).

The analytical complexities associated with predicting the discharge of a contained gas from its vessel through a long isothermal tube are simplified. The choking and unchoking temporal regions are shown to be dependent upon the form taken for friction factor, and the solution is therefore shown to depend rather intimately on such forms. Measured and calculated vessel pressure histories are favorably compared for the case of an ideal gas (He) discharging to the atmosphere in laminar flow through a tube of length to diameter ratio 1.2 x 10^4.

PROPERTIES AND STRUCTURE OF FLUIDS

49334 (AD-A—060957) **Effects of atomic structure on the radiation dynamics of an optically thick plasma. Memorandum report.** Duston, D.; Davis, J.; Whitney, K.G. (Naval Research Lab., Washington, DC (USA)). Sep 1978. 61p. NTIS PC A04/MF A01.

A theoretical model has been developed to calculate the effects of atomic level structure on the ionization and radiation dynamics of high-density, high-temperature plasmas. The model solves time-dependent rate equations to calculate the population densities of excited states in a stationary, homogeneous, uniformly-heated volume of plasma. The transport and reabsorption of emitted radiation in an optically thick plasma are modeled phenomenologically with a formalism based on frequency diffusion of the photons. This radiation transport model has been used to obtain preliminary results for comparisons between optically thin and optically thick plasmas. Also, an extensive analysis of several methods for generating electron-ion collisional excitation rates for K-shell ions is presented, as well as a study of the effects of ion-ion collisions on the level populations for relevant plasma conditions.

49335 (CONF-7810187—(absts)) **Program and abstracts.** (State Univ. of New York, Buffalo (USA)). 1978. Contract ED-78-G-08-1564. 155p. Dep. NTIS, PC A08/MF A01.

From 31. annual gaseous electronics conference; Buffalo, NY, USA (17 Oct 1978).

This volume contains the program and abstracts of the conference. The following topics are included: metal vapor molecular lasers, magnetohydrodynamics, rare gas halide and nuclear pumped lasers, transfer mechanisms in arcs, kinetic processes in rare gas halide lasers, arcs and flows, XeF kinetics and lasers, fundamental processes in excimer lasers, electrode effects and vacuum arcs, electron and ion transport, ion interactions and mobilities, glow discharges, diagnostics and afterglows, dissociative recombination, electron ionization and excitation, rare gas excimers and group VI lasers, breakdown, novel laser pumping techniques, electrode-related discharge phenomena, photon interactions, attachment, plasma chemistry and infrared lasers, electron scattering, and reactions of excited species. (RWR)

MAGNETOHYDRODYNAMICS

REFER ALSO TO CITATION(S) 49335

49336 (UCRL—52492) **ANIMAL code.** Lindemuth, I.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 Feb 1979. Contract W-7405-ENG-48. 55p. Dep. NTIS, PC E02/MF E02.

This report describes ANIMAL, a two-dimensional Eulerian magnetohydrodynamic computer code. ANIMAL's physical model also appears. Formulated are temporal and spatial finite-difference equations in a manner that facilitates implementation of the algorithm. Outlined are the functions of the algorithm's FORTRAN subroutines and variables.

SUPERFLUIDITY

49337 (CU-TP—141) **Effective potential and Bogoliubov transformation for liquid helium.** Friedberg, R.; Sheth, S. (Columbia Univ., New York (USA). Dept. of Physics). [nd]. Contract EY-76-C-02-2271. 8p. Dep. NTIS, PC A02/MF A01.

It is suggested that when the bare-interaction between helium is replaced by an effective interaction (calculable from the potential), the resulting hamiltonian may be treated by a Bogoliubov transformation. Some preliminary results are described.

PARTICLE INTERACTIONS AND PROPERTIES - EXPERIMENTAL

ELECTROMAGNETIC INTERACTIONS

REFER ALSO TO CITATION(S) 49341, 49361

49338 (COO—2232A-69) **Study of high mass e^+e^- pairs produced in p—p collisions at the CERN ISR.** Angelis, A.L.S.; Blumenfeld, B.J.; Camilleri, L. (Rockefeller Univ., New York (USA); European Organization for Nuclear Research, Geneva (Switzerland)). 20 Sep 1978. Contract EY-76-C-02-2232. 16p. (CONF-780826—34). Dep. NTIS, PC A02/MF A01.

From 19. conference on high energy physics; Tokyo, Japan (23 Aug 1978).

An apparatus consisting of a superconducting solenoidal magnet, cylindrical drift chambers, and two arrays of lead—glass Cerenkov counters was used at the CERN ISR to study the production of e^+e^- pairs of invariant mass larger than 6 GeV/c^2. Measurements of $(d^2\sigma/dmdy)/sub\ y=0/$ for the e^+e^- continuum and of $B(d\sigma/dy)/sub\ y=0/$ for the Y resonances will be presented for $\sqrt{s}$ = 62.4 GeV. The mean p/sub T/ of the e^+e^- pairs and the multiplicity and momentum spectrum of associated particles will be discussed. 6 references.

49339 (SLAC-PUB—2350) **Some first results from the Mark II at SPEAR.** Abrams, G.S.; Alam, M.S.; Blocker, C.A. (Stanford Linear Accelerator Center, CA (USA); California Univ., Berkeley (USA)). Jun 1979. Contract EY-76-C-03-0515. 5p. (LBL—9320; CONF-790642—2). Dep. NTIS, PC A02/MF A01.

From International conference on high energy physics; Geneva, Switzerland (27 Jun 1979).

Preliminary results are given from the Mark II experiment at SPEAR on radiative decays of the psi' (3684) and on inclusive baryon production from 3.67 to 7.4 GeV center-of-mass energy. A 90% confidence level upper limit of 0.12% is given for $BR[ps.' \rightarrow \gamma eta'/sub\ c/(3455)] \times BR[eta'/sub\ c/(3455 \rightarrow \gamma psi)]$. 10 references.

WEAK INTERACTIONS

49340 (LBL—9348) **Study of rare muon induced processes.** Clark, A.R.; Johnson, K.J.; Kerth, L.T. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; Fermi National Accelerator Lab., Batavia, IL (USA); Princeton Univ., NJ (USA). Joseph Henry Labs.). Jun 1979. Contract W-7405-ENG-48. 7p. (CONF-790642—3). Dep. NTIS, PC A02/MF A01.

From International conference on high energy physics; Geneva, Switzerland (27 Jun 1979).

Interactions of the type $\mu N \rightarrow (n\mu)X$ (n = 1, 2, 3, 4, 5) are being studied with high sensitivity in the Multimuon Spectrometer in

the Fermilab muon beam. Results are reported on inelastic structure functions, production of psi(3100) and exotic multimuon final states.

STRONG BARYON-INDUCED INTERACTIONS

REFER ALSO TO CITATION(S) 49338

STRONG MESON-INDUCED INTERACTIONS

49341 (SLAC—220) **D meson production in e^+e^- annihilation.** Rapidis, P.A. (Stanford Linear Accelerator Center, CA (USA)). Jun 1979. Contract EY-76-C-03-0515. 106p. Dep. NTIS, PC A08/MF A01.

Thesis.

The production of D mesons in e^+e^- annihilation for the center-of-mass energy range 3.7 to 7.0 GeV was studied with the MARK I magnetic detector at the Stanford Positron Electron Accelerating Rings facility. A resonance was observed in the total cross section for hadron production in e^+e^- annihilation at an energy just above the threshold for charm production. This resonance, which is named psi'', has a mass of 3772 +- 6 MeV/c^2, a total width of 28 +- 5 MeV/c^2, a partial width to electron pairs of 345 +- 85 eV/c^2, and decays almost exclusively into D anti D pairs. The psi'' provides a rich source of background-free and kinematically well defined D mesons for study. From produced in the decay of the psi'' the masses cf the D^0 and D^+ mesons were determined to be 1863.3 +- 0.9 MeV/c^2 and 1868.3 +- 0.9 MeV/c^2 respectively. Also the branching fractions for D^0 decay to $K^-\pi^+$, anti $K^0\pi^+\pi^-$ and $K^-\pi^+\pi^-\pi^+$ were determined to be (2.2 +- 0.6)%, (4.0 +- 1.3)%, and (3.2 +- 1.1)% and the branching fractions for D^+ decay to anti $K^0\pi^+$ and $K^-\pi^+\pi^+$ to be (1.5 +- 0.60)% and (3.9 +- 1.0)%. The average number of kaons per D decay was found to be 0.52 +- 0.14 K^0's and 0.42 +- 0.12 K^+'s. The rate for inclusive production of D mesons at center-of-mass energies above the psi'' was measured; it is found that it can account for most, if not all, of the observed increase in the total hadronic cross-section for center-of-mass energies above 4 GeV. The inclusive momentum and energy spectra for D's were measured at the highest available center-of-mass energy (7 GeV). The energy spectra are rapidly decreasing functions of energy with a slope similar to the slope of the charged pion spectrum at the same center-of-mass energy. This behavior suggests that the fragmentation function of the charmed quark into charmed mesons is a decreasing function of the scaling variable z = 2E/sub D//E/sub CM/. 81 references.

PARTICLE INTERACTIONS AND PROPERTIES - THEORETICAL

STRONG INTERACTIONS, GENERAL

49342 (LBL—9015) **Bootstrapping quarks and gluons.** Chew, G.F. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Apr 1979. Contract W-7405-ENG-48. 51p. (CONF-790365—4). Dep. NTIS, PC A04/MF A01.

From 16. rencontre de moriond; Les Arcs, Savoie, France (17 Mar 1979).

Dual topological unitarization (DTU) - the approach to S-matrix causality and unitarity through combinatorial topology - is reviewed. Amplitudes associated with triangulated spheres are shown to constitute the core of particle physics. Each sphere is covered by triangulated disc faces corresponding to hadrons. The leading current candidate for the hadron-face triangulation pattern employs 3-triangle basic subdiscs whose orientations correspond to baryon number and topological color. Additional peripheral triangles lie along the hadron-face perimeter. Certain combinations of peripheral triangles with a basic-disc triangle can be identified as quarks, the flavor of a quark corresponding to the orientation of its edges that lie on the hadron-face perimeter. Both baryon number and flavor are additively conserved. Quark helicity, which can be associated with triangle-interior orientation, is not uniformly conserved and interacts with particle momentum, whereas flavor does not. Three different colors attach to the 3 quarks associated with a single basic subdisc, but there is no additive physical conservation law associated with color. There is interplay between color and quark helicity. In hadron faces with more than one basic subdisc, there may occur pairs of adjacent flavorless but colored triangles with net helicity +-1 that are identifiable as gluons. Broken symmetry is an automatic feature of the bootstrap. T, C and P symmetries, as well as up-down flavor symmetry, persist on all orientable surfaces.

PHYSICS RESEARCH (CONT.)

REFER ALSO TO CITATION(S) 48749

NUCLEAR PROPERTIES AND REACTIONS, A=1-5, EXPERIMENTAL

NUCLEAR REACTIONS AND SCATTERING

49343 (LA—7899-MS) **Hydrogen scattering cross section, $^1H(n,n)^1H$.** Stewart, L. (Los Alamos Scientific Lab., NM (USA)). Jul 1979. Contract W-7405-ENG-36. 17p. Dep. NTIS, PC A02/MF A01.

The status of the hydrogen scattering cross section is reviewed with particular emphasis on standards applications. The ENDF/B-V evaluation is described in detail and compared with experimental data. 58 references.

NUCLEAR PROPERTIES AND REACTIONS, A=90-149, EXPERIMENTAL

REFER ALSO TO CITATION(S) 49298

ENERGY LEVELS AND TRANSITIONS

49344 (LBL—9212) **Collective properties of odd-mass Sb, I, Cs, and La nuclei.** Fossan, D.B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1979. Contract W-7405-ENG-48. 29p. (CONF-790592—1). Dep. NTIS, PC A03/MF A01.

From International conference on the structure of medium-heavy nuclei; Rhodos, Greece (1 May 1979).

The collective properties for the Z approximately greater than 50 transition region were studied via heavy-ion induced γ-ray experiments using $^{6,7}Li$, ^{10}B, $^{12,13}C$, ^{14}N, and ^{16}O beams. The high-spin systematics for odd-mass $^{113-125}Sb$ (Z = 51), $^{115-127}I$ (Z = 53), $^{119-133}Cs$ (Z = 55), and $^{125-127}La$ (Z = 57) nuclei were obtained. Two collective features were observed, the first being systematic ΔJ = 1 bands built on low-lying 1g/sub 9/2/ proton-hole states, and the second systematic ΔJ = 2 bands built on 2d/sub 5/2/, 1g/sub 7/2/, and 1h/sub 11/2/ quasi-proton states. Unexpected properties were observed. 27 references.

NUCLEAR REACTIONS AND SCATTERING

REFER ALSO TO CITATION(S) 49344

NUCLEAR THEORY

NUCLEAR REACTIONS AND SCATTERING

49345 (CONF-790545—2) **Extended TDHF approximation illuminates the approach to thermal equilibrium.** Wong, C.Y.; Tang, H.H.K. (Oak Ridge National Lab., TN (USA); Yale Univ., New Haven, CT (USA)). 1979. Contract W-7405-ENG-26. 7p. Dep. NTIS, PC A02/MF A01.

From Time-dependent Hartree-Fock international workshop; Gif-sur-Yvette, France (28 May 1979).

The region of validity of the TDHF approximation is extended by including the collisions between particles. The resultant equations of motion consist of a modified TDHF equation and a master equation for the occupation numbers. Concepts such as entropy, temperature, and thermal equilibrium can be quantitatively introduced. The well-known H-theorem that entropy never decreases is proved for nuclear systems. New types of level crossing formulas are obtained to shed light on how a nonequilibrium finite nuclear system approaches thermal equilibrium. 2 figures.

49346 (CONF-790545—3) **Classical transcription of the TDHF approximation.** Wong, C.Y. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 8p. Dep. NTIS, PC A02/MF A01.

From Time-dependent Hartree-Fock international workshop; Gif-sur-Yvette, France (28 May 1979).

The time-dependent Hartree—Fock approximation is shown to be approximately equivalent to a purely classical pseudoparticle simulation. In this simulation, a collection of pseudoparticles are introduced to discretize the phase space of spatial and momentum coordinates. The dynamics is completely determined by following the pseudoparticle trajectories which are the same as the trajectories of real particles moving in the self-consistent field. An application of these concepts to nearly-head-on heavy-ion collisions leads to a better understanding of the origin of the low-l fusion window obtained in the TDHF calculations. 1 table.

49347 (CONF-790660—1) **Approach to thermal equilibrium.** Wong, C.Y.; Toepffer, C. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 11p. Dep. NTIS, PC A02/MF A01.

From Conference on large amplitude collective nuclear motion; Lake Balaton, Hungary (10 Jun 1979).

The thermal relaxation time is determined for the approach to thermal equilibrium by solving the Uehling—Uhlenbeck equation. The initial momentum distribution is taken to be a sphere with an outer spherical shell. It is found that thermal equilibrium is essentially reached within a time of about 40 fm/c (= 1.33×10^{-22} sec). The order of magnitude of this relaxation time agrees with that inferred from recent deep-inelastic heavy-ion experiments.

49348 (LA-UR—79-1511) **Dynamics of nuclear fission and heavy-ion reactions.** Nix, J.R.; Sierk, A.J. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 16p. (CONF-790660—3). Dep. NTIS, PC A02/MF A01.

From Conference on large amplitude collective nuclear motion; Lake Balaton, Hungary (10 Jun 1979).

Large-amplitude collective motion in fission and heavy-ion reactions is studied by solving classical equations of motion for the time evolution of the nuclear shape. In the nuclear potential energy of deformation, the generalized surface energy was calculated by means of a double volume integral of a Yukawa-plus-exponential function, which was obtained by requiring that two semi-infinite slabs of constant-density nuclear matter have minimum energy at zero separation. The collective kinetic energy is calculated for nuclear flow that is a superposition of incompressible, nearly irrotational collective-shape motion and rigid-body rotation. Nuclear dissipation is included by means of the Rayleigh dissipation function, which depends upon the physical mechanism that converts collective energy into internal energy. For both ordinary two-body viscosity and a combined wall and window one-body dissipation, fission-fragment kinetic energies are calculated for the fission of nuclei throughout the periodic table and compare with experimental results. Finally, the one-body dynamics of nucleons inside a cylinder colliding with a moving piston is explicitly studied by solving exactly the collisionless Boltzmann equation for the distribution function. By examining the relative phases of the pressure at the piston and the piston's velocity, a dissipative force and an elastic restoring force can be separately identified. 9 references.

49349 (LBL—8950) **Three lectures on macroscopic aspects of nuclear dynamics.** Swiatecki, W.J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1979. Contract W-7405-ENG-48. 69p. Dep. NTIS, PC A04/MF A01.

These lectures concentrate on macroscopic aspects of nuclear dynamics, those aspects that come into prominence when the number of nucleons, A, is large, $A >> 1$. An attempt is made to set up a theory of the dynamics of nuclear shape changes, for small (subsonic) collective velocities. To set up the equations of motion one needs three forces: conservative, dissipative, and inertial. The first lecture deals with statics, i.e., it discusses methods of treating the Potential Energy Function of nuclear systems. From the Potential Energy the conservative forces that drive the time evolution of a nuclear configuration can be deduced. The division of the underlying potential energy into Local, Proximity, and Global terms is stressed. The second lecture deals with dynamical aspects, especially with the nuclear Dissipation Function, which describes how dissipative frictional forces oppose the conservative driving forces. The underlying physics is the approximate validity of the Independent-Particle model. This, combined with the Randomization Hypothesis, leads to simple formulas that suggest that dissipative forces may often overshadow the inertial forces. The third lecture outlines the kind of dynamics that results from the balance of these forces, and describes a number of applications to nuclear fission and heavy-ion collisions of this New Dynamics. Particularly simple equations of motion are set up, and some of the consequences are explored. 18 references, 31 figures, 3 tables. (RWR)

49350 (LBL—9244) **In search of high density collective phenomena in nuclear collision.** Gyulassy, M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1979. Contract W-7405-ENG-48. 17p. (CONF-790660—4). Dep. NTIS, PC A02/MF A01.

From Conference on large amplitude collective nuclear motion; Lake Balaton, Hungary (10 Jun 1979).

The progress made toward uncovering signatures of collective phenomena is reviewed. Elements of the basic reaction mechanism leading to a complex background are first discussed. Possible hints of collective phenomena in proton and pion single and double inclusive spectra as well as π^- multiplicity data are then described. 6 figures, 2 tables.

SPONTANEOUS AND INDUCED FISSION

REFER ALSO TO CITATION(S) 49348, 49349

RADIATION AND SHIELDING PHYSICS

49351 (SAND—79-0684C) **Ion-beam-induced migration and its effect on concentration profiles.** Myers, S.M. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 70p. (CONF-790671—2). Dep. NTIS, PC A04/MF A01.

From 4. international conference on ion beam analysis; Aarhus, Denmark (25 Jun 1979).

The mechanisms by which ion irradiation influences atomic transport are reviewed, including cascade mixing, enhanced diffusion via mobile point defects, rapid diffusion along extended defects, and solute trapping at irradiation damage. The effects of these processes on measured concentration profiles are considered for high-energy ion beam analysis.

RADIATION PHYSICS

49352 (LA—7879-MS) **SNEX: semianalytic solution of the one-dimensional discrete ordinates (S/sub n/) transport equations with diamond differenced angular fluxes.** Wienke, B.R. (Los Alamos Scientific Lab., NM (USA)). Jun 1979. Contract W-7405-ENG-36. 28p. Dep. NTIS, PC A03/MF A01.

SNEX is a code which exactly solves the spatial single group, one-dimensional (plane, cylinder, sphere) discrete ordinates transport equations with diamond approximation for the angular fluxes. Its purposes are to provide a standard for comparisons of spatial differencing schemes as well as an exact numerical solution to the discrete ordinates equations in one-dimensional geometries. Full solutions are generated by numerically integrating the inhomogeneous source terms and adding them to the homogeneous (analytic) solutions in the standard fashion. Simple relationships between angular quadratures permit application of the method to plane, cylindrical and spherical geometries. Analysis is confined to isotropic scattering. Simple theory and methodology are presented and discussed. A code listing and sample problems are also included.

49353 (LA-UR—79-1435) **New technique for backscattering analysis.** Keaton, P.W.; Peercy, P.S.; Doyle, B.L.; Maggiore, C.J. (Los Alamos Scientific Lab., NM (USA); Sandia Labs., Albuquerque, NM (USA)). 1979. Contract W-7405-ENG-36. 12p. (CONF-790671—1). Dep. NTIS, PC A02/MF A01.

From 4. international conference on ion beam analysis; Aarhus, Denmark (25 Jun 1979).

A new technique for analyzing Rutherford backscattering spectra is suggested. By determining the ratio of the range of a particle of energy E, to that of a particle whose energy is a fraction of E, two basic integral equations are converted into a pair of linear equations that are easy to solve and manipulate. The applicability of this formalism is demonstrated by using it to measure the stopping power of gold for alpha particles with energies 1.2, 2.2, 3.7, 5.2, and 7.1 MeV. 4 references.

49354 (UCRL—82684) **Micro-fresnel structures for microscopy of laser generated bright x-ray sources.** Ceglio, N.M.; Shavers, D.C.; Flanders, D.C.; Smith, H.I. (California Univ., Livermore (USA). Lawrence Livermore Lab.; Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 5 Jun 1979. Contract W-7405-ENG-48. 30p. (CONF-790674—1). Dep. NTIS, PC A03/MF A01.

From Conference on ultrasoft X-ray microscopy; New York, NY, USA (13 Jun 1979).

A brief parametric survey of the x-ray characteristics of a gold micro-disk irradiated at 3×10^{14} watt/cm^2 by a 1 nsec Nd-glass laser pulse has been provided as an example of a laser generated bright x-ray source. It was shown that a simple phenomenological model of the laser generated x-ray source as a microscopic equilibrium plasma radiating as a blackbody for a finite time determined by its hydrodynamic disassembly and radiation losses, serves to provide an adequate approximation to the x-ray characteristics of such sources. The current state of x-ray microscopy within the LLL laser fusion program was briefly reviewed. Kirpatrick—Baez grazing incidence reflection x-ray microscopes are being used to provide 3 to 5 μm resolution, broadband images ($\Delta E/E \sim 0.3$) over a spectral range from .6 keV to 3.5 keV. Zone Plate Coded Imaging is used to provide 5 to 10 μm resolution, broadband ($\Delta E/E \sim 0.5$) images over a spectral range from 3 keV to 50 keV. Efficient x-ray lensing elements with anticipated submicron resolution are being developed for narrowband ($\Delta E/E \sim 10^{-3}$) imaging applications over a spectral range .1 keV to 8 keV. The x-ray lens design is that of a transmission blazed Fresnel phase plate. Micro—Fresnel zone plates with 3200 A minimum linewidth have been fabricated and preliminary resolution tests begun. The first resolution test pattern, having minimum linewidth of 2.5 μm, was imaged in lambda = 8.34 A light with no difficulty. Newer test patterns with submicron minimum line are being prepared for the next stage of resolution testing. An off-axis Fresnel zone plate with 1600 A minimum linewidth is presently being fabricated for use as an imaging spectrometer in order to provide spatially separated, chromatically distinct images of characteristic line emissions from laser fusion targets.

NEUTRON INTERACTIONS WITH MATTER

49355 (CONF-790738—1) **Itinerant electron magnetism in 3d-transition metals.** Cooke, J.F. (Oak Ridge National Lab., TN (USA)). May 1979. Contract W-7405-ENG-26. 24p. Dep. NTIS, PC A02/MF A01.

From Joint INTERMAG-MMM conference; New York, NY, USA (17 Jul 1979).

Inelastic neutron scattering experiments performed on the 3-d transition metal ferromagnets have revealed striking behavior associated with the magnetic excitations found in these materials. Of particular importance is the disappearance of the spin-wave mode above a certain cut-off wave vector and the existence of spin-wave mode above a certain cut-off wave vector and the existence of spin-waves well above the Curie temperature. These phenomena can be understood if the magnetic electrons are assumed to be itinerant. At low temperatures, quantitative predictions of the itinerant electron theory based on KKR energy band calculations have been found to be in excellent agreement with experiment. In addition, these calculations predicted the existence of an optical spin-wave mode in nickel which was recently observed. A comparable numerical investigation at higher temperatures must await the development of a realistic finite temperature theory, which is currently under investigation.

49356 (UCRL—82792) **Differencing asymptotic diffusion theory.** Zimmerman, G.B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Jun 1979. Contract W-7405-ENG-48. 14p. (CONF-790675—1). Dep. NTIS, PC A02/MF A01.

From 3. annual conference on transport processes in laser plasmas; Traverse City, MI, USA (18 Jun 1979).

A diffusion theory is presented which extends asymptotic diffusion to non-uniform material properties. Finite difference methods for the diffusion theory naturally result in jump conditions on interfaces when appropriate.

SOLID STATE PHYSICS

REFER ALSO TO CITATION(S) 48941, 49351

49357 (AD-A—061241) **Solid state research, 1978:2. Quarterly technical summary report, 1 February—30 April 1978.** McWhorter, A.L. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 15 May 1978. Contract F19628-78-C-0002. 72p. NTIS PC A04/MF A01.

This report covers in detail the solid state research work on the Solid State Division at Lincoln Laboratory for the period 1 February through 30 April 1978. The topics covered are Solid State Device Research, Quantum Electronics, Materials Research, Microelectronics, and Surface-Wave Technology. Funding is primarily provided by the Air Force, with additional support provided by the Army, ARPA, NSF, and DOE.

49358 (BNL—26432) **Linear chain of classical Heisenberg spins with three or four spin interactions.** Barma, M. (Tata Inst. of Fundamental Research, Bombay (India); Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 7p. (CONF-790909—1). Dep. NTIS, PC A02/MF A01.

From International conference on magnetism; Munich, F.R. Germany (Sep 1979).

The free energy of a classical Heisenberg chain with three or four spin interactions is shown to equal that of a spin-infinity Ising model. The two-spin Heisenberg correlation function equals a many-spin Ising correlation function and can oscillate with distance.

49359 (CONF-790538—12) **Physical correlation effects in the lattice gas.** Murch, G.E.; Thorn, R.J. (Argonne National Lab., IL (USA)). 1979. Contract W-31-109-ENG-38. 9p. Dep. NTIS, PC A02/MF A01.

From Fast ion transport in solids-electrode and electrolytes conference; Lake Geneva, WI, USA (21 May 1979).

The circumstances of the existence of the physical correlation factor in the Nernst—Einstein relation are discussed. Use is then made of the linear phenomenological equations of irreversible thermodynamics to show that the physical correlation factor must also be present in the Darken equation. Computer simulation results in the nearest neighbor interacting lattice gas are then presented to verify this finding.

SOLID STATE PLASMA

49360 (CONF-790620—2) **Symmetry properties of the transport coefficients of charged particles in disordered materials.** Baird, J.K. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 8p. Dep. NTIS, PC A02/MF A01.

From Dundee conference on application of numerical analysis; Dundee, UK (26 Jun 1979).

The transport coefficients of a charged particle in an isotropic material are shown to be even functions of the applied electric field. We discuss the limitation which this result and its consequences place upon formulae used to represent these coefficients.

SUPERCONDUCTIVITY

GENERAL THEORY

49361 (CU-TP—144) **Multi-vortex solutions of the Ginzburg—Landau equations.** (Columbia Univ., New York (USA). Dept. of Physics). 1978. Contract EY-76-C-02-2271. 16p. Dep. NTIS, PC A02/MF A01.

Multi-vortex solutions of the Ginzburg—Landau equations (or, equivalently, of the Abelian Higgs model) are considered for a special choice of parameters. It is shown that for every n there is a 2n - parameter family of n-vortex solutions. It is conjectured that the parameters are just those needed to specify the positions of the vortices and that the vortices behave very much like noninteracting particles. 17 references.

ACOUSTIC, ELECTRIC, MAGNETIC, OPTICAL, AND THERMAL PHENOMENA

REFER ALSO TO CITATION(S) 48900, 48936

49362 (BNL—26379) **Magnetic ordering in rare-earth ternary superconductors.** Shirane, G.; Thomlinson, W.; Moncton, D.E. (Brookhaven National Lab., Upton, NY (USA); Bell Labs., Murray Hill, NJ (USA)). 1979. Contract EY-76-C-02-0016. 12p. (CONF-790653—7). Dep. NTIS, PC A02/MF A01.

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

A review is given of current neutron scattering studies of rare-earth(R) ternary superconductors: RMo_6X_8(X = S or Se) and $ErRh_4B_4$. Most of these compounds develop antiferromagnetic long-range order which coexists microscopically with superconductivity. Two compounds, $HoMo_6S_8$ and $ErRh_4B_4$, become ferromagnetic causing the destruction of superconductivity. In $ErRh_4B_4$, both superconducting and ferromagnetic regions are simultaneously present between 0.9 and 1.2°K but microscopic coexistence is not indicated. However, in this temperature range, magnetic fluctuations occurring in the superconducting regions take the forms of a magnetic spiral with a wavelength of ~ 100 A in order to accommodate superconductivity. This observation is in good agreement with the theoretical predictions of Blount and Varma.

49363 (CONF-790653—3) **Phonon density of states in V_3Si.** Smith, H.G.; Mueller, F.; Arko, A.; Lowndes, D. (Oak Ridge National Lab., TN (USA)). Jun 1979. Contract W-7405-ENG-26. 6p. Dep. NTIS, PC A02/MF A01.

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The observation by inelastic neutron scattering techniques of a high energy peak in the phonon spectrum (14 THz) of V_3Si is reported, and is attributed to a peak in the phonon density of states due to vanadium motions by the incoherent inelastic neutron scattering process. (GHT)

49364 (CONF-790653—4) **Progress in calculations of the superconducting properties of transition metals.** Butler, W.H. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 14p. Dep. NTIS, PC A02/MF A01.

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

First principles calculations of the electron—phonon parameters of d-band metals can now be performed to an accuracy of about 10% for averaged quantities such as the mass enhancement or the room temperature resistivity. Quantities such as the spectral function $\alpha^2F(\omega)$ or the phonon linewidth which describe the electron—phonon interaction in more detail can also be calculated. Agreement between calculated and experimental phonon linewidths is generally good but there are differences between the experimental and calculated versions of $\alpha^2F(\omega)$. Calculations of the thermodynamic critical field and the upper critical field for Nb agree well with experiment.

THEORETICAL PHYSICS

CLASSICAL AND QUANTUM MECHANICS

49365 (ORO—5126-66) **Quantized gauge invariant periodic TDHF solutions.** Kan, K.K.; Griffin, J.J.; Lichtner, P.C.; Dworzecka, M. (Maryland Univ., College Park (USA). Dept. of Physics

and Astronomy). Apr 1979. Contract EY-76-S-05-5126. 11p. Dep. NTIS, PC A02/MF A01.

The time-dependent Hartree-Fock method (TDHF) is used to study steady state large-amplitude collective motions, such as vibration and rotation. The central aspect explored is the periodicity. By a close analogy with the exact Schroedinger eigenstates, a subset of periodic TDHF solutions, the gauge invariant periodic solutions are considered. The TDHF supports a continuous family of periodic solutions, but only a discrete subset of these is gauge invariant. Also it is proven that these discrete gauge invariant periodic solutions obey the Bohr—Summerfeld quantization rule. The energy spectrum of the gauge invariant periodic solutions is compared with the exact eigenenergies in one specific example. The study implies that the gauge invariant periodic TDHF solutions are a very promising approximate description of the exact Schroedinger eigenstates. 10 references. (JFP)

ELECTRICITY AND MAGNETISM

49366 (SAND—79-1093C) **Finite-element model of compressed magnetic field current generators.** Tucker, T.J. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 21p. (CONF-790540—14). Dep. NTIS, PC A02/MF A01.

From 2. international conference on megagauss magnetic field generation and related topics; Washington, DC, USA (29 May 1979).

A computer code (SWL) has been developed to model the behavior of compressed magnetic field current generators. This code, based on a finite-element representation of the device, yields predictions of performance in good agreement with experiment, is sufficiently flexible to accommodate a wide variety of design options, and makes economical use of computer time and storage.

MATHEMATICAL PHYSICS

REFER ALSO TO CITATION(S) 49365

FUSION ENERGY

49367 (CONF-790664—1) **International information exchange in fusion research.** Strickler, C.S. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 12p. Dep. NTIS, PC A02/MF A01.

From 70. annual meeting of special libraries association, physics-astronomy-mathematics division; Honolulu, HI, USA (9 Jun 1979).

Formal and informal agreements exist between the US and several other countries, assuring the unrestricted exchange of magnetic fusion information. The Fusion Energy Library at Oak Ridge National Laboratory uses the US Department of Energy standard distribution system and exchange agreements to ensure the receipt of current reports. Selective dissemination of information, computer networks, and exchange programs are additional means for information gathering. The importance of these means as they relate to the fusion program in the US and specifically at ORNL is discussed.

PLASMA RESEARCH

PLASMA CONFINEMENT AND HEATING

49368 (UCRL—50051-79-1, pp 31-33) **Applied plasma physics.** 15 May 1979.

In Magnetic fusion energy. Quarterly report, January—March 1979.

Applied Plasma Physics is a major sub-organizational unit of the Magnetic Fusion Energy (MFE) Program. It includes Fusion Plasma Theory and Experimental Plasma Research. The Fusion Plasma Theory group has the responsibility for developing theoretical-computational models in the general areas of plasma properties, equilibrium, stability, transport, and atomic physics. This group has responsibility for giving guidance to the mirror experimental program. There is a formal division of the group into theory and computational; however, in this report the efforts of the two areas are not separated since many projects have contributions from members of both. Under the Experimental Plasma Research Program we are developing a neutral-beam source, the intense, pulsed ion-neutral source (IPINS), for the generation of a reversed-field configuration on 2XIIB. We are also studying the feasibility of using certain neutron-detection techniques as plasma diagnostics in the next generation of thermonuclear experiments.

49369 (WFPS-TME—79-018) **Analysis of the early phase of tokamak plasma ohmic heating.** von Valtier, E. (Michigan Univ., Ann Arbor (USA)). Apr 1979. Contract EG-77-C-02-4231. 92p. Dep. NTIS, PC A05/MF A01.

A study of ohmically heated tokamak systems has been performed in which the evolution of the plasma is followed through the initiation period up to 100 eV. A zero-dimensional model of the bulk plasma is utilized, with a one-dimensional model of the plasma inductance. Losses due to ionization and oxygen impurity processes are evaluated using the best available atomic data. The total OH system energy expended in forming and heating the plasma up to a reference temperature of 100 eV is calculated and found to be a function of the maximum induced loop voltage. The latter is found to be limited by thresholds for runaway electron production. Finally, preliminary results are presented on fully one-dimensional calculations which verify rigorously the formation of inverted temperature and current profiles as early as 50 eV in the heating process.

PLASMA DIAGNOSTICS

REFER ALSO TO CITATION(S) 49421

49370 (UCRL—82158) **Neutron diagnostic that measures Z/sub eff/ in a neutral-beam-heated Tokomak.** Slaughter, D.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Apr 1979. Contract W-7405-ENG-26. 13p. (CONF-790645—1). Dep. NTIS, PC A02/MF A01.

From IEEE international conference on plasma science; Montreal, Canada (4 Jun 1979).

The rate of pitch-angle scattering in a beam-driven Tokomak is proportional to Z/sub eff/ when neutral deuterium is injected parallel or antiparallel to the toroidal field B/sub T/. The energy spectrum of neutrons produced by D—D or D—T reactions is sensitive to the angular distribution of reacting energetic deuterons so that a measurement of the spectrum may be used to infer Z/sub eff/. Energy spectra of neutrons emitted parallel to B/sub T/ during simultaneous co- and counter-injection were calculated for the case of 120-keV beams by using a PPPL code. The results were then convoluted with spectrometer lineshapes determined experimentally for a system used to measure neutron spectra during a 1.0-s source pulse. Results indicate that Z/sub eff/ in the range of 1 to 4 may be determined with uncertainties of +- 0.25 for D—D plasma and +- 0.5 for D—T plasma, provided the ion temperature T/sub i/ is well known. However, the spectrometer energy resolution is not adequate to determine T/sub i/ directly from a neutron—spectrum measurement. In the absence of accurate T/sub i/ data, the uncertainty in Z/sub eff/ is approximately +- 1. In either case, impurity identification is not established by this type of measurement.

PLASMA KINETICS - EXPERIMENTAL

49371 (UCRL—81907) **Energy coupling in the plasma focus.** Wainwright, T.E.; Pickles, W.L.; Sahlin, H.L.; Price, D.F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 Apr 1979. Contract W-7405-ENG-48. 14p. (CONF-781247—4). Dep. NTIS, PC A02/MF A01.

From 2. international conference on energy storage, compression and switching; Venice, Italy (5 Dec 1978).

Experiments have been performed with a 125-kJ plasma focus to investigate mechanisms for rapid coupling of inductively-stored energy into plasmas. The coupling can take place through the formation of an electron or ion beam that deposits its energy in a target or directly by the penetration of the magnetic field into a resistive plasma. Some preliminary results from experiments of both types are described. The experiments use a replaceable conical anode tip that is intended to guide the focus to within a few millimeters of the axis, where it can suddenly deliver energy either to a small target or to particles that are accelerated. X-ray and fast-ion diagnostics have been used to study the effects.

49372 **Low-Z impurities in the PLT Tokamak.** Hinnov, E.; Suckewer, S.; Bol, K.; Hawryluk, R.J.; Hosea, J.; Meservey, E. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Plasma Phys.;* **20**: No. 8, 723-734(Aug 1978).

Concentrations and influx rates of oxygen and carbon ions have been determined in a variety of discharges in the PLT Tokamak. Oxygen, and to a lesser extent carbon are found to affect strongly the plasma behavior, mostly by changes in resistivity. The principal effect appears to be peripheral cooling by oxygen radiation, which changes the radial distribution of current density and temperature, and simultaneously inhibits the influx of high-Z limiter and wall material.

PLASMA KINETICS - THEORETICAL

49373 (AD-A—061028) **Astron type equilibrium in the absence of an applied magnetic field. Memorandum report.** Kapetanakos, C.A. (Naval Research Lab., Washington, DC (USA)). 14 Nov 1978. 10p. NTIS PC A02/MF A01.

It is shown that the Vlasov-Maxwell equations predict the existence of rotating layer equilibria (rigid rotor) in the absence of an external magnetic field, provided that the density of the layer exceeds a critical density. (Author)

49374 (AD-A—061630) **A finite-circuit-element code for modeling the dynamics of a gyrating charged-particle beam. Interim report.** Book, D.L.; Turchi, P.J.; Stein, D.L. (Naval Research Lab., Washington, DC (USA)). May 1978. 68p. NTIS PC A04/MF A01.

A method is described for calculating the interaction between an imploding liner, a magnetically confined charge particle ring (Astron e-layer, ion ring) and a target plasma, based on the equations of the equivalent circuit. Expressing the electrodynamical behavior in terms of inductive coupling between circular current loops, so that changes in geometry and plasma parameters are described by changes in the induction coefficients, means that only ordinary differential equations arise, in contrast with fluid descriptions. Induced electron currents are conveniently included in the model. Application to a beam-target fusion system driven by the compression of an ion ring is described as an illustration of the utility of the technique. (Author)

49375 (LBL—8528) **Equilibrium and stability in strongly inhomogeneous plasmas.** Mynick, H.E. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Oct 1978. Contract W-7405-ENG-48. 223p. Dep. NTIS, PC A10/MF A01.

Thesis.

The equilibrium of strongly inhomogeneous, collisionless, slab plasmas, is studied using a generalized version of a formalism previously developed, which permits the generation of self-consistent equilibria, for plasmas with arbitrary magnetic shear, and variation of magnetic field strength. A systematic procedure is developed for deriving the form of the guiding-center Hamiltonian K, for finite eta, in an axisymmetric geometry. In the process of obtaining K, an expression for the first adiabatic invariant (the gyroaction) is obtained, which generalizes the usual expression 1/2 mv/sub perpendicular/^{2}/Ω/sub c/ (Ω/sub c/ = eB/mc), to finite eta and magnetic shear. A formalism is developed for the study of the stability of strongly-inhomogeneous, magnetized slab plasmas; it is then applied to the ion-drift-cyclotron instability.

49376 (PPL—1564) **Iterative metric method for solving the inverse tokamak equilibrium problem.** Delucia, J.; Jardin, S.C.; Todd, A.M.M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jul 1979. Contract EY-76-C-02-3073. 53p. Dep. NTIS, PC A04/MF A01.

A method is presented for solving the toroidal magnetohydrodynamic equilibrium equation in a coordinate system based on the magnetic field lines. Both fixed boundary (conducting shell) and free boundary (external coil) boundary conditions are considered. A comparison with a special analytic solution is made. The method is useful for obtaining equilibria to use in tokamak stability and transport calculations.

PLASMA PRODUCTION

49377 **Plasma generating device with hairpin-shaped cathode filaments.** Ehlers, K.W. (to Dept. of Energy). US Patent 4,140,943. 20 Feb 1979. Filed date 1 Jun 1977. 8p.

Patent Application No. 802,401.

A device is described for generating a homogeneous ion—electron plasma from which a large ion beam can be extracted. The device utilizes hairpin-shaped filaments lining at least portions of the wall of the chamber which have been rotated 90 degrees from prior known approaches. This provides a very significant result in that the DC current flowing through the filaments produces a small solenoidal magnetic field that impedes the emitted electrons from striking the walls of the chamber, which may be of a cylindrical or rectangular configuration. This improves the efficiency of the ion source and provides additional space for more filaments, while providing a very uniform plasma density profile which is noise-free.

49378 **Laser induced plasma in super pressure gases.** Baek, S.H. Austin, TX; Univ. of Texas (1978). 151p. University Microfilms Order No. 79-10,927.

Thesis (Ph. D.).

Laser interactions with laser produced plasma in high pressure gases were studied in two ways. Theoretically a mathematical model was set up using five hydrodynamic equations for numerical simulation of the laser—plasma interactions at super high pressure of H_2 gas. Experimentally a ruby laser was focused into various gases at high pressures. The dynamic properties of laser induced plasma and resultant radiation effects were recorded and analyzed.

PLASMA INSTABILITIES

REFER ALSO TO CITATION(S) 49379

PLASMA WAVE PHENOMENA

49379 (LA-UR—79-576) **Statistical theory of Langmuir turbulence.** DuBois, D.F.; Rose, H.A.; Goldman, M.V. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 8p. (CONF-790708—1). Dep. NTIS, PC A02/MF A01.

From XIV conference internationale sur les phenomenes d'ionisation dans les gaz; Grenoble, France (9 Jul 1979).

A statistical theory of Langmuir turbulence is developed by applying a generalization of the direction interaction approximation (DIA) of Kraichnan to the Zakharov equations describing Langmuir turbulence. 7 references.

FUSION POWER PLANT TECHNOLOGY

49380 (COO—2456-T8) **High-beta tokamak and belt pinch research: Torus I and II. Quarterly status report, 1 February 1978—31 March 1978.** (Columbia Univ., New York (USA). School of Engineering and Applied Science). 5 Apr 1978. Contract EY-76-S-02-2456. 3p. Dep. NTIS, PC A02/MF A01.

This report describes work for the past two months. The use of magnetic probes and Thomson and Rayleigh scattering diagnostics of Torus I is mentioned. Some construction progress of Torus II is reported. (MOW)

49381 (NRL-MR—4029) **Optimization of stabilized imploding liner fusion reactors.** Turchi, P.J.; Book, D.L.; Burton, R.L. (Naval Research Lab., Washington, DC (USA)). 25 Jun 1979. Contract EX-76-A-34-1006. 15p. (CONF-780953—12). Dep. NTIS, PC A02/MF A01.

From 10. symposium on fusion technology; Padova, Italy (4 Sep 1978).

In the NRL LINUS concept for controlled fusion systems, a rotating liquid metal cylinder or liner is imploded onto a trapped plasma/magnetic field payload to obtain fusion temperatures and near-megagauss magnetic field levels by adiabatic compression. The combined use of liner rotation and a free-piston driving technique eliminates Rayleigh-Taylor instabilities and permits safe, repetitive implosion-reexpansion cycles. Optimization of system size is accomplished in terms of the implosion radius—ratio and liner compressibility. Trade-offs between reactor size and initial plasma temperature are indicated.

49382 (UCRL—50051-79-1) **Magnetic fusion energy. Quarterly report, January—March 1979.** Harrison, M.A.; Strack, J.R. (eds.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 May 1979. Contract W-7405-ENG-48. 41p. Dep. NTIS, PC A03/MF A01.

Separate abstracts were prepared for each of the three included sections. (MOW)

49383 (UCRL—50051-79-1, pp 1-25) **Confinement systems.** 15 May 1979.

In Magnetic fusion energy. Quarterly report, January—March 1979.

The following three confinement systems now in operation or under construction at LLL are: the Tandem Mirror Experiment (TMX), the Beta II, and the Mirror Fusion Test Facility (MFTF). Some general research progress during this period is reported for each. (MOW)

49384 (UCRL—50051-79-1, pp 26-31) **Development and technology.** 15 May 1979.

In Magnetic fusion energy. Quarterly report, January—March 1979.

This program is aimed at developing the technology required for carrying out the mirror-reactor program. Much of this work applies to the national program and fusion in general; it covers the following areas: (1) superconducting-magnet development, (2) neutral-beam program (including beam direct conversion and vacuum technology); (3) direct conversion, (4) materials program, and (5) reactor-design studies.

49385 **Internal ring end stoppering for open-ended plasma containing multicoil solenoid.** Dagazian, R.T. (to Dept. of Energy). US Patent Application 932,151. 9 Aug 1978. 13p.

The specification relates to an end-stoppering device for plasma containing multicoil solenoids. Circular ring conductors are disposed concentrically within the solenoid near its ends, spaced inwardly of the walls of the solenoid and from one another. An electric current passed through the coils of the solenoid induces electric current in the opposite direction in the ring conductors. This produces a magnetic field configuration having a separatrix surface; the configuration acts as an end-stopper for the plasma containing solenoid. In addition, end mirrors can be added to further enhance local mirroring and thereby assist in end-stoppering the plasma within the solenoid.

49386 **Small-aspect-ratio, small-major-radius Tokamak reactors.** Jassby, D.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Comments Plasma Phys. Controlled Fusion;* **3**: No. 6, 151-158(Mar 1978).

The proposed configuration and operating mode make it possible to realize a copper-coil ignition test reactor with small major radius and very small aspect ratio, allowing a stable plasma equilibrium with β approximately 0.1.

MAGNET COILS AND FIELDS

REFER ALSO TO CITATION(S) 48993, 48994

49387 (BNL—25806) **DEALS: a maintainable superconducting magnet system for tokamak fusion reactors.** Hseih, S.Y.; Danby, G.; Powell, J.R. (Brookhaven National Lab., Upton, NY (USA); Grumman Aerospace Corp., Bethpage, NY (USA)). 1979. Contract EY-76-C-02-0016. 23p. (CONF-790815—1). Dep. NTIS, PC A02/MF A01.

From Cryogenic engineering conference; Madison, WI, USA (21 Aug 1979).

The feasibility of demountable superconducting magnet systems has been examined in a design study of a DEALS [Demountable Externally Anchored Low Stress] TF magnet for an HFITR [High Field Ignition Test Reactor] Tokamak device. All parts of the system appear feasible, including the demountable superconducting joints. Measurements on small scale prototype joints indicate that movable pressure contact joints exhibit acceptable electrical, mechanical, and cryogenic performance. Such joints permit a relatively simple support structure and are readily demountable. Assembly and disassembly sequences are described whereby any failed portion of the magnet, or any part of the reactor inside the TF coils can be removed and replaced if necessary.

49388 (UCRL—13967) **Cooldown and warmup thermal analysis of the mirror fusion test facility (MFTF) superconducting magnet.** O'Neill, R.F.; Tatro, R.E. (General Dynamics/Astronautics, San Diego, CA (USA)). 1 Mar 1979. Contract W-7405-ENG-48. 22p. (CONF-790802—18). Dep. NTIS, PC A02/MF A01.

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

General Dynamics Convair Division has performed a series of detailed cooldown and warmup thermal analyses to support the design of the Lawrence Livermore Laboratory (LLL), Mirror Fusion Test Facility (MFTF) magnet system. The analyses were conducted under LLL Contract 9815603. All analysis objectives were achieved, including definition of a cooldown and warmup operating schedule which can (1) effect complete cooldown and warmup within three to five days (an LLL requirement), (2) yield acceptable levels of thermally-induced stresses resulting from transverse and longitudinal structural temperature differentials, and (3) yield acceptable stress levels with or without flow imbalances in separate sections of the magnet. The analyses were executed through the National magnetic Fusion Energy Computer Center (NMFECC) at LLL.

49389 (UCRL—13975) **General Dynamics Convair Division approach to structural analysis of large superconducting coils.** Baldi, R.W. (General Dynamics/Convair, San Diego, CA (USA)). 21 Mar 1979. Contract W-7405-ENG-48. 15p. (CONF-790802—31). Dep. NTIS, PC A02/MF A01.

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Most of the procedures and techniques described were developed over the past three years. Starting in late 1976, development began on high-accuracy computer codes for electromagnetic field and force analysis. This effort resulted in completion of a family of computer programs called MAGIC (MAGnetic Integration Calcaultion). Included in this group of programs is a post-processor called POSTMAGIC that links MAGIC to GDSAP (General Dynamics Structural Analysis Program) by automatically transferring force data. Integrating these computer programs afforded us the capability to readily analyze several different conditions that are anticipated to occur during tokamak operation. During 1977 we initiated the development of the CONVERT program that effectively links our THERMAL ANALYZER program to GDSAP by automatically transferring temperature data. The CONVERT program allowed us the capability to readily predict thermal stresses at several different time phases during the computer-simulated cooldown and warmup cycle. This feature aided us in determining the most crucial time phases and to adjust recommended operating procedure to minimize risk.

49390 (UCRL—81591) **Structural materials for fusion magnets.** Henning, C.D.; Dalder, E.N.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Mar 1979. Contract W-7405-ENG-48. 17p. (CONF-790802—32). Dep. NTIS, PC A02/MF A01.

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Of major technical and cost impact to Magnetic Fusion Energy development are the materials for the magnet structure. Those materials and fabrication techniques that are attractive to fusion magnets are discussed and relative comparisons made. Considerations such as strength, toughness, and joining techniques are balanced against recommended design criteria to reach an optimum design. Several examples of material selection are cited for large fusion magnets such as Base II, the Mirror Fusion Test Facility, the Toroidal Fusion Test Facility, and the Large Coil Project.

49391 (UCRL—82142) **Plasma crowbars in cylindrical flux compression experiments.** Suter, L.J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 May 1979. Contract W-7405-ENG-48. 29p. (CONF-790540—13). Dep. NTIS, PC A03/MF A01.

From 2. international conference on megagauss magnetic field generation and related topics; Washington, DC, USA (29 May 1979).

We have done a series of one- and two-dimensional calculations of hard-core Z-pinch flux compression experiments in order to study the effect of a plasma on these systems. These calculations show that including a plasma can reduce the amount of flux lost during the compression. Flux losses to the outer wall of such experiments can be greatly reduced by a plasma conducting sheath which forms along the wall. This conducting sheath consists of a cold, dense high β, unmagnetized plasma which has enough pressure to balance a large field gradient. Flux which is lost into the center conductor is not effectively stopped by this plasma sheath until late in the implosion, at which time a layer similar to the one formed at the outer wall is created. Two-dimensionl simulations show that flux losses due to arching along the sliding contact of the experiment can be effectively stopped by the formation of a plasma conducting sheath.

49392 **Electron effects in ion-current field reversal.** Baldwin, D.E.; Rensink, M.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). *Comments Plasma Phys. Controlled Fusion;* **4**: No. 2, 55-63(1978).

Electron effects in ion-current field reversal are considered.

49393 **Cryogenic technology and superconductivity in controlled fusion.** Chernoplyokov, N.A.; Ivanov, D.P.; Keilin, V.E.; Panov, D.A.; Zotov, I.L. (I.V. Kurchatov Atomic Energy Inst., Moscow, USSR). pp 18-34 of Proceedings of the seventh international cryogenic engineering conference. Guildford, England; IPC Science and Technology Press (1978).

From 7. cryogenic engineering conference; South Kensington, London, UK (4 Jul 1978).

One of the most prospective ways to satisfy man's energy needs is the controlled thermonuclear reaction (CTR). Cryogenics allows not only to improve the processes and hardware used; ignoring it practically excludes some approaches (e.g., magnetic confinement systems considered to be the most advanced today). To realize the advantages offered by cryogenics to CTR programs great efforts are to be aimed at creation of SC magnet systems (with refrigerators) about two orders greater and much more reliable than those existing.

49394 **Design and development of the US-TESPE toroidal coil.** Hoenig, M.O. (Massachusetts Inst. of Tech., Cambridge). pp 156-170 of Proceedings of the seventh international cryogenic engineering conference. Guildford, England; IPC Science and Technology Press (1978).

From 7. cryogenic engineering conference; South Kensington, London, UK (4 Jul 1978).

For a number of years we have been active in the development of force cooled superconducting (FCS) coils for tokamak fusion plasma containment. We have recently been charged by the US Department of Energy with the responsibility for an advanced 1-meter-scale test coil called "US-TESPE." Current plants call for the joint design and development of the coil at this laboratory and at the Oak Ridge National Laboratory and its test operation as part of a six-coil toroidal cluster "TESPE" at the Kernforschungszentrum at Karlsruhe, West Germany, in 1979—1980. The coil is to operate at 7000A in a self-field of 7.0T. It will have overall dimensions of 0.95, 0.85 and 0.25 m (height, width and thickness, respectively). It will be built using approximately 500 m of Nb_3Sn FCS 8 mm x 8 mm cabled conductor encapsulated in stainless steel tubing. This paper describes the design of the US-TESPE coil as well as the development of its Nb_3Sn cable.

49395 **Developments in large internally cooled high field superconductors.** Sanger, P.A.; Marancik, W.; Mayer, E.; Adam, E.; Gregory, E. (Airco Central Research Labs., Murray Hill, NJ). pp 555-560 of Proceedings of the seventh international cryogenic engineering conference. Guildford, England; IPC Science and Technology Press (1978).

From 7. cryogenic engineering conference; South Kensington, London, UK (4 Jul 1978).

The trend in large superconducting magnets has been toward conductors with high cooling surface area to maintain cryostability. Several of these conductors including an extended area pool boiling conductor and supercritical He forced flow conductor have been developed and produced in long lengths at Airco. These conductors are described and their assembly schemes presented. Nondestructive in-line testing using ultrasonic and eddy current techniques have been developed. The appropriate techniques for each type of conductor are described in the paper.

49396 Flow characteristics of forced-flow Nb_3Sn conductors for toroidal-field coils. Janocko, M.A.; Blaugher, R.D.; Eckels, P.W. (Westinghouse Electric Corp., Pittsburgh, PA). pp 679-685 of Proceedings of the seventh international cryogenic engineering conference. Guildford, England; IPC Science and Technology Press (1978).

From 7. cryogenic engineering conference; South Kensington, London, UK (4 Jul 1978).

The present design of the Westinghouse (LCP) toroidal-field coil utilizes a forced-flow supercritical helium cooled Nb_3Sn conductor. The cooling characteristics of this conductor must be determined in order to evaluate conductor performance. Helium flow tests on the full-scale conductor were performed to measure pressure drop under conditions approximating those specified for the actual magnet. The test apparatus was designed around a closed-cycle refrigeration system which provided the required flow rates of single-phase helium at 4.2 and 77 K and pressures above 2.3 atmospheres. A description of the experimental arrangement and test results for a specific conductor configuration is reported.

POWER SUPPLIES, ENERGY STORAGE

REFER ALSO TO CITATION(S) 49411

49397 (SAND—79-0730C) MITL: A 2-D code to investigate electron flow through non-uniform field region of magnetically insulated transmission lines. Neau, E.L.; VanDevender, J.P. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 4p. (CONF-790622—14). Dep. NTIS, PC A02/MF A01.

From Pulsed power conference; Lubbock, TX, USA (12 Jun 1979).

Self-magnetically insulated, high voltage transmission lines are used in inertial confinement fusion particle accelerators to transmit power from the vacuum insulator to the diode. Injection and output convoluted sections pose special problems in establishing the desired electron flow pattern needed to maintain high overall efficiency. A time independent, 2-D numerical code for planar or triplate geometries calculates the motion of a test electron through the tapered input or output convolutes. The 1-D parapotential model is assumed to be appropriate at each position and the magnetic field and potential distribution are calculated in the vicinity of the particle. The electric field is then calculated from Gauss's Law, and the electron motion is calculated relativistically. The results show that the electron canonical momentum in the direction of flow change as the electron passes through a convoluted geometry.

49398 (SAND—79-0778C) Recent developments in high average power driver technology. Prestwich, K.R.; Buttram, M.T.; Rohwein, G.J>. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 10p. (CONF-790723—6). Dep. NTIS, PC A02/MF A01.

From 3. international topical conference on high power electron and ion beam research and technology; Novosibirsk, USSR (3 Jul 1979).

Inertial confinement fusion (ICF) reactors will require driver systems operating with tens to hundreds of megawatts of average power. The pulse power technology that will be required to build such drivers is in a primitive state of development. Recent developments in repetitive pulse power are discussed. A high-voltage transformer has been developed and operated at 3 MV in a single pulse experiment and is being tested at 1.5 MV, 5 kj and 10 pps. A low-loss, 1 MV, 10 kj, 10 pps Marx generator is being tested. Test results from gas-dynamic spark gaps that operate both in the 100 kV and 700 kV range are reported. A 250 kV, 1.5 kA/cm^2, 30 ns electron beam diode has operated stably for 1.6 x 10^5 pulses.

49399 (SAND—79-0933C) Pulsed power for fusion. Martin, T.H. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 7p. (CONF-790622—7). Dep. NTIS, PC A02/MF A01.

From Pulsed power conference; Lubbock, TX, USA (12 Jun 1979).

Research conducted in support of the pulsed power approach to fusion has resulted in the creation of an extendable accelerator technology that could be used at levels up to 100 TW and 30 MJ. These types of accelerators are efficient (about 30 to 50 percent) and for ion outputs in the 1 to 3 MJ range they may provide an approach to economically feasible 200 MW electric power reactor. Repetitive pulsing of the pulsed power system for $> 10^9$ shot lifetimes must be solved along with ion beam concentration, bunching, and drifting.

49400 (UCRL—82473) Applying a Compensated Pulsed Alternator to a flashlamp load for NOVA. Carder, B.M.; Merritt, B.T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Jun 1979. Contract W-7405-ENG-48. 16p. (CONF-790622—23). Dep. NTIS, PC A02/MF A01.

From Pulsed power conference; Lubbock, TX, USA (12 Jun 1979).

The Compensated Pulsed Alternator (CPA) is a large rotating machine that will convert mechanical, rotationally stored energy into a single electrical impulse of very high power. It is being optimized for driving flashlamps in the very large NOVA Nd:glass laser system. The machine is a rotary flux compression device, and for maximum performance, it requires start-up current. We report upon a circuit that will provide this current and that will also assist in triggering the flashlamps. This circuit has been tested with a 200 kilojoule capacitor bank and it is now being tested with a small 200 kilojoule CPA. Large Nove-size machines will require output energies in excess of 5 megajoules. We also present empirically tested formulae that will assist in matching the Nova flashlamp load to any given size CPA machine.

49401 (UCRL—82479) Balanced, parallel operation of flashlamps. Carder, B.M.; Merritt, B.T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Jun 1979. Contract W-7405-ENG-48. 13p. (CONF-790622—20). Dep. NTIS, PC A02/MF A01.

From Pulsed power conference; Lubbock, TX, USA (12 Jun 1979).

A new energy store, the Compensated Pulsed Alternator (CPA), promises to be a cost effective substitute for capacitors to drive flashlamps that pump large Nd:glass lasers. Because the CPA is large and discrete, it will be necessary that it drive many parallel flashlamp circuits, presenting a problem in equal current distribution. Current division to +- 20% between parallel flashlamps has been achieved, but this is marginal for laser pumping. A method is presented here that provides equal current sharing to about 1%, and it includes fused protection against short circuit faults. The method was tested with eight parallel circuits, including both open-circuit and short-circuit fault tests.

49402 (UCRL—82661) Near and long term pulse power requirements for laser driven inertial confinement fusion. Gagnon, W.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Jun 1979. Contract W-7405-ENG-48. 25p. (CONF-790622—22). Dep. NTIS, PC A02/MF A01.

From Pulsed power conference; Lubbock, TX, USA (12 Jun 1979).

At the Lawrence Livermore Laboraory, major emphasis has been placed upon the development of large, ND:glass laser systems in order to address the basic physics issues associated with light driven fusion targets. A parallel program is directed toward the development of lasers which exhibit higher efficiencies and shorter wavelengths and are thus more suitable as drivers for fusion power plants. This paper discusses the pulse power technology which has been developed to meet the near and far term needs of the laser fusion program at Livermore.

49403 Compensated pulsed alternator. Weldon, W.F.; Driga, M.D.; Woodson, H.H. (to Dept. of Energy). US Patent Application 930,616. 3 Aug 1978. 14p.

This invention relates to an electromechanical energy converter with inertial energy storage. The device, a single phase, two or multi-pole alternator with stationary field coils, and a rotating armature is provided. The rotor itself may be of laminated steel for slower pulses or for faster pulses should be nonmagnetic and electrically nonconductive in order to allow rapid penetration of the field as the armature coil rotates. The armature coil comprises a plurality of power generating conductors mounted on the rotor. The alternator may also include a stationary or counterrotating compensating coil to increase the output voltage thereof and to reduce the internal impedance of the alternator at the moment of peak output. As the machine voltage rises sinusoidally, an external trigger switch is adapted to be closed at the appropriate time to create the desired output current from said alternator to an external load circuit, and as the output current passes through zero a self-commutating effect is provided to allow the switch to disconnect the generator from the external circuit.

HEATING AND FUELING SYSTEMS

49404 (AD-A—061429) Supplemental development testing of cryogen cooled systems for cryopumping gaseous hydrogen. Final report. Miller, H.R. (Arnold Engineering Development Center, Arnold Air Force Station, TN (USA)). 6 Jun 1978. 14p. NTIS PC A02/MF A01.

Three additional type A cryopump assemblies were tested in the Aerospace Research Chamber (12V) test unit, von Karman Gas

Dynamics Facility (VKF) during April 24 to May 15, 1978, in support of Neutral Beam Injection work being done by the Energy Research Development Administration (ERDA), Oak Ridge National Laboratory (ORNL). These cryopumps were additional requirements which resulted from previous developmental work at AEDC. The objectives of the tests were to verify operating procedures, hydrogen pumping speeds, and pump operating endurance under operational and steady state conditions. Each pump assembly exceeded the operational design requirements specified. Post-test checks and inspections revealed no degradation of pump components due to test environments. Upon completion of testing, the pump assemblies were shipped to ORNL for incorporation into their Neutral Beam Injection Systems. (Author)

49405 (ORNL/TM—6949) **Shielding calculations for the TFTR neutral beam injectors.** Santoro, R.T.; Lillie, R.A.; Alsmiller, R.G. Jr.; Barnes, J.M. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 31p. Dep. NTIS, PC A03/MF A01.

Two-dimensional discrete ordinates calculations have been performed to determine the location and thickness of concrete shielding around the Tokamak Fusion Test Reactor (TFTR) neutral beam injectors. Two sets of calculations were performed: one to determine the dose equivalent rate on the roof and walls of the test cell building when no injectors are present, and one to determine the contribution to the dose equivalent rate at these locations from radiation streaming through the injection duct. Shielding the side and rear of the neutral beam injector with 0.305 and 0.61 m of concrete, respectively, and lining the inside of the test cell wall with an additional layer of concrete having a thickness of 0.305 m and a height above the axis of deuteron injection of 3.10 m are sufficient to maintain the biological dose equivalent rate outside the test cell to ~ 1 mrem/DT pulse.

49406 **Apparatus for neutralization of accelerated ions.** Fink, J.H.; Frank, A.M. (to Dept. of Energy). US Patent 4,140,576. 20 Feb 1979. Filed date 22 Sep 1976. 4p.

Patent Application No. 725,906.

Apparatus is described for neutralization of a beam of accelerated ions, such as hydrogen negative ions (H^-), using relatively efficient strip diode lasers which emit monochromatically at an appropriate wavelength (λ = 8000 A for H^- ions) to strip the excess electrons by photodetachment. A cavity, formed by two or more reflectors spaced apart, causes the laser beams to undergo multiple reflections within the cavity, thus increasing the efficiency and reducing the illumination required to obtain an acceptable percentage (~ 85%) of neutralization.

49407 (UCRL—15013) **Manufacturing cost study on the ion sources for the Mirror Fusion Test Facility.** (Varian Associates, Palo Alto, CA (USA). Palo Alto Microwave Tube Div.). [nd]. Contract W-7405-ENG-48. 99p. Dep. NTIS, PC A05/MF A01.

A study of the cost of manufacturing 48 ion sources for the Mirror Fusion Test Facility is described. The estimate is built up from individual part costs and assembly operation times for the 80 kV prototype source constructed by LLL and described by LLL drawings furnished during December 1978. Recommendations for cost reduction are made.

TRITIUM PROCESSING, ENVIRONMENT AND SAFETY

49408 (UCID—18192) **Environmental impact assessment for the Nova projects (Building 391 complex).** Odell, B.N. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 4 Jun 1979. Contract W-7405-ENG-48. 22p. Dep. NTIS, PC A02/MF A01.

The environmental impact assessment of the Nova projects (Building 391 Complex) describes (1) the proposed actions, (2) the existing environment in and around the Livermore Valley, and (3) the potential environmental impacts from the construction and operation of these facilities. It shows that the proposed action does not conflict with any Federal, State, Regional, or Local Plans and Programs. Possible alternatives to the proposed action are discussed. However, it is concluded that the proposed actions were the most reasonable of the alternatives and would involve relatively minor adverse environmental impacts.

49409 **Method and apparatus for controlling accidental releases of tritium.** Galloway, T.R. (to Dept. of Energy). US Patent Application 930,629. 3 Aug 1978. 11p.

The improvement in a tritium control system is based on a catalytic oxidation reactor wherein accidental releases of tritium into room air are controlled by flooding the catalytic oxidation reactor with hydrogen when the tritium concentration in the room air exceeds a specified limit. The sudden flooding with hydrogen heats the catalyst to a high temperature within seconds, thereby greatly increasing the catalytic oxidation rate of tritium to tritiated water vapor. Thus, the catalyst is heated only when needed. In addition to the heating effect, the hydrogen flow also swamps the tritium and further reduces the tritium release.

INERTIAL CONFINEMENT TECHNOLOGY

REFER ALSO TO CITATION(S) 49002, 49003, 49397, 49398, 49399, 49400, 49401, 49402, 49408

49410 (COO—4253-7) **Tripling of CO_2 laser radiation in DBr, DCl and Se. Final technical report, 1 May 1977—31 Jan 1979.** Yoder, M.J. (Avco-Everett Research Lab., Inc., Everett, MA (USA)). Mar 1979. Contract ES-77-C-02-4253. 128p. Dep. NTIS, PC A07/MF A01.

This report discusses frequency tripling of CO_2 lasers in deuterium chloride (DCl), deuterium bromide (DBr), and selenium (Se) gases. Theoretical tripling equations are reviewed and summarized. Third order nonlinear susceptibilities, chi/sup (3)/, for DCl, DBr and Se are calculated. Experimental measurements of frequency tripling in high pressure DCl and DBr are discussed. Resonantly enhanced four-wave sum-frequency generation in Se using simultaneous 9.5 and 10.6 μm TEA CO_2 laser pulses is demonstrated. The necessary selenium vapor density is generated in a shock tube. All of the experiments are in relatively good agreement with theory and results in chi /sup (3)/ values of 1.4 x 10^{-37} ESU for DBr, 2.0 x 10^{-36} for DCl and 1.1 x 10^{-35} for Se (at 2000°K). Scaling equations are discussed which predict frequency conversion efficiencies of > 50% in DCl and Se using gigawatt power, nanosecond pulsed CO_2 lasers and reasonably sized conversion cells.

49411 (SAND—78-2239) **Assembly and handling apparatus for the EBFA Marx generator.** Staller, G.E.; Hiett, G.E.; Hamilton, I.D.; Aker, M.F.; Daniels, G.A. (Sandia Labs., Albuquerque, NM (USA)). May 1979. Contract EY-76-C-04-0789. 16p. Dep. NTIS, PC A02/MF A01.

Marx generators, a major slow-pulsed power component in Sandia Laboratories' Electron Beam Fusion Accelerator (EBFA), were assembled at a remote facility modified to utilize an assembly-line technique. Due to the size and weight of the various components, as well as the final Marx generator assembly, special handling apparatus was designed. Time and manpower constraints required that this assembly be done in parallel with the construction of the Electron Beam Fusion Facility (EBFF). The completed Marx generators were temporarily stored and then moved from the assembly building to the EBFF using special transportation racks designed specifically for this purpose.

49412 (SAND—79-0734C) **Electron and ion beam transport to fusion targets.** Freeman, J.R.; Baker, L.; Miller, P.A.; Mix, L.P.; Olsen, J.N.; Poukey, J.W.; Wright, T.P. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 10p. (CONF-790723—7). Dep. NTIS, PC A02/MF A01.

From 3. international topical conference on high power electron and ion beam research and technology; Novosibirsk, USSR (3 Jul 1979).

ICF reactors have been proposed which incorporate a gas-filled chamber to reduce x-ray and debris loading of the first wall. Focused beams of either electrons or ions must be transported efficiently for 2-4 m to a centrally located fusion target. Laser-initiated current-carrying plasma discharge channels provide the guiding magnetic field and the charge- and current-neutralizing medium required for beam propagation. Computational studies of plasma channel formation in air using a 1-D MHD model with multigroup radiation diffusion have provided a good comparison with the expansions velocity and time dependent refractivity profile determined by holographic interferometry. Trajectory calculations have identified a beam expansion mechanism which combines with the usual ohmic dissipation to reduce somewhat the transported beam fluence for electrons. Additional trajectory calculations have been performed for both electrons and light ions to predict the limits on the particle current density which can be delivered to a central target by overlapping the many independently-generated beams. Critical features of the use of plasma channels for transport and overlap of charged particle beams are being tested experimentally with up to twelve electron beams from the Proto II accelerator.

49413 (UCRL—82539) **Compact 5 x 10^{12} AMP/SEC rail-gun pulser for a laser plasma shutter.** Bradley, L.P.; Orham, E.L.; Stowers, I.F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Jun 1979. Contract W-7405-ENG-48. 14p. (CONF-790622—21). Dep. NTIS, PC A02/MF A01.

From Pulsed power conference; Lubbock, TX, USA (12 Jun 1979).

We have developed a rail-gun plasma source to produce a plasma of $10^{12}cm^{-3}$ particle density and project it with a velocity of 3.9 cm/μs. This device will be used in a output spatial filter of Nova to project a critical density plasma across an optical beam path and block laser retroreflected light. The object of this paper is to describe the design of a pulser appropriate to the Shiva laser fusion facility, and to describe the preliminary design of a higher current prototype pulser for Nova the laser fusion research facility under construction at Lawrence Livermore Laboratory.

49414 (UCRL—82586) **Transport of intense particle beams with application to heavy ion fusion.** Buchanan, H.L.; Chambers, F.W.; Lee, E.P.; Yu, S.S.; Briggs, R.J.; Rosenbluth, M.N. (California Univ., Livermore (USA). Lawrence Livermore Lab.; Institute for Advanced Study, Princeton, NJ (USA)). 22 Jun 1979. Contract W-7405-ENG-48. 12p. (CONF-790723—8). Dep. NTIS, PC A02/MF A01.

From 3. international topical conference on high power electron and ion beam research and technology; Novosibirsk, USSR (3 Jul 1979).

An attractive feature of the high energy (> GeV) heavy ion beam approach to inertial fusion, as compared with other particle beam systems, is the relative simplicity involved in the transport and focusing of energy on the target inside a reactor chamber. While this focusing could be done in vacuum by conventional methods with multiple beams, there are significant advantages in reactor design if one can operate at gas pressures around one torr. In this paper we summarize the results of our studies of heavy ion beam transport in gases. With good enough charge and current neutralization, one could get a ballistically-converging beam envelope down to a few millimeters over a 10 meter path inside the chamber. Problems of beam filamentation place important restrictions on this approach. We also discuss transport in a self-focused mode, where a relatively stable pressure window is predicted similar to the observed window for electron beam transport.

49415 **Method of mounting a fuel pellet in a laser-excited fusion reactor.** Hirsch, R.L. (to Dept. of Energy). US Patent 4,142,088. 27 Feb 1979. Filed date 27 Jan 1976. 12p.

Patent Application No. 649,948.

A method is described for irradiating a target, wherein a single laser light beam from a source and a mirror close to the target are used with aperture means for directing laser light to interact with the target over a broad area of the surface, and for protecting the laser light source.

49416 **Method for forming electrically charged laser targets.** Goodman, R.K.; Hunt, A.L. (to Dept. of Energy). US Patent 4,138,609. 6 Feb 1979. Filed date 22 Jun 1976. 4p.

Patent Application No. 698,557.

Electrically chargeable laser targets and method for forming such charged targets in order to improve their guidance along a predetermined desired trajectory are described. This is accomplished by the incorporation of a small amount of an additive to the target material which will increase the electrical conductivity thereof, and thereby enhance the charge placed upon the target material for guidance thereof by electrostatic or magnetic steering mechanisms, without adversely affecting the target when illuminated by laser energy.

49417 **Magnetic confinement system using charged ammonia targets.** Porter, G.D.; Bogdanoff, A. (to Dept. of Energy). US Patent 4,138,317. 6 Feb 1979. Filed date 5 Jun 1978. 4p.

Patent Application No. 912,782.

A system is described for guiding charged laser targets to a predetermined focal spot of a laser along generally arbitrary, and especially horizontal, directions which comprises a series of electrostatic sensors which provide inputs to a computer for real time calculation of position, velocity, and direction of the target along an initial injection trajectory.

COMPONENT DEVELOPMENT AND MATERIALS TESTING

REFER ALSO TO CITATION(S) 48931, 49404, 49405

49418 (CONF-790125—71) **Radiation induced detrapping of implanted deuterium in BeO by high energy ^{3}He and proton irradiation.** Scherzer, B.M.U.; Blewer, R.S.; Behrisch, R.; Schulz, R.; Roth, J.; Borders, J.; Langley, R. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.); Sandia Labs., Albuquerque, NM (USA); Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 4p. Dep. NTIS, PC A02/MF A01.

From 1. topical meeting on fusion reactor materials; Miami Beach, FL, USA (29 Jan 1979).

BeO layers formed on Be are implanted with 5 keV deuterium ions and the amount of gas retained is determined using the D(^{3}He,H)^{4}He nuclear reaction. Detrapping of the retained deuterium by 790 keV ^{3}He and 2.2 MeV H bombardment is measured at temperatures between 140 and 470°K and detrapping cross sections are determined. The maximum detrapping yields found are 17 D/^{3}He and 0.8 D/H. The results indicate that the observed radiation induced detrapping is caused by electronic excitation.

49419 (CONF-790125—72) **Simulation of first wall damage: effects of the method of gas implantation.** Packan, N.H.; Farrell, K. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 5p. Dep. NTIS, PC A02/MF A01.

From 1. topical meeting on fusion reactor materials; Miami Beach, FL, USA (29 Jan 1979).

Cavity formation in an austenitic alloy of similar composition to Type 316 stainless steel has been explored with regard to various methods of gas implantation. Irradiations were conducted at 900 K to doses of 1, 10, and 70 dpa with helium injection levels of 20 appm/dpa. Highest swelling (18%) was exhibited by the unimplanted reference material; a lesser amount by simultaneous helium injection (11%). Greatly reduced swelling due to profuse cavity nucleation was the results of the preinjection of 1400 appm He, either at room temperature (S = 1%) or at 900 K (4%). The dislocation density was not sensitive to helium injection technique. Simultaneous injection of 50 appm H/dpa, along with the He, may have caused a modest increase in the cavity and dislocation concentrations at higher doses. The observations are compared with a theory of void growth kinetics to estimate the relative influence of voids and dislocations as point defect sinks.

49420 (CONF-790125—76) **Compatibility of molten salts with Type 316 stainless steel and lithium.** Keiser, J.R.; deVan, J.H.; Lawrence, E.J. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-76. 4p. Dep. NTIS, PC A02/MF A01.

From 1. topical meeting on fusion reactor materials; Miami Beach, FL, USA (29 Jan 1979).

Molten salts with possible application in fusion reactors have been studied. The corrosion rate of Type 316 stainless steel in LiF—BeF_2, KNO_3—$NaNO_2$—$NaNO_3$, and LiF—LiCl—LiBr was strongly affected by the temperature and oxidation potential of the salt. A rapid exothermic reaction occurred when KNO_3—$NaNO_2$—$NaNO_3$ was melted with lithium.

49421 (PPPL—1551) **Vacuum system design and tritium inventory for the TFTR charge exchange diagnostic.** Medley, S.S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). May 1979. Contract EY-76-C-02-3073. 50p. Dep. NTIS, PC A03/MF A01.

The charge exchange diagnostic for the TFTR is comprised of two analyzer systems which contain a total of twenty independent mass/energy analyzers and one diagnostic neutral beam tentatively rated at 80 keV, 15 A. The associated vacuum systems were analyzed using the Vacuum System Transient Simulator (VSTS) computer program which models the transient transport of multi-gas species through complex networks of ducts, valves, traps, vacuum pumps, and other related vacuum system components. In addition to providing improved design performance at reduced cost, the analysis yields estimates for the exchange of tritium from the torus to the diagnostic components and of the diagnostic working gases to the torus.

GENERAL AND MISCELLANEOUS

MANAGEMENT

REFER ALSO TO CITATION(S) 48744

49422 (AD-A—061294) **Annual summary of research programs number 25, 1 April 1977 through 31 March 1978.** (University of Southern California, Los Angeles (USA). Electronic Sciences Lab.). Apr 1978. Contract F44620-71-C-0067. 140p. NTIS PC A07/MF A01.

This document is an Annual Summary of Research Programs issued by the Electronic Sciences Laboratory, University of Southern California, Los Angeles, California. It summarizes the research activity during the period 1 April 1977 through 31 March 1978. Findings in this report are not to be construed as an official U.S. Government position. (Author)

49423 (DOE/AD—0027/1) **Comparison of compensation paid scientists and engineers in research and development, DOE national survey of compensation, 1978 data.** (Department of Energy, Oak Ridge, TN (USA). Oak Ridge Operations Office). Mar 1979. 32p. Dep. NTIS, PC A03/MF A01.

This study compares the characteristics and compensation of DOE contractor-operated laboratories with those reported in the 1978 National Survey of Compensation. Total survey representation increased this year. Findings are presented with respect to education levels, management levels, age distribution, field of highest degree, and compensation levels. Salary levels and trends are examined at some length. 20 figures, 5 tables. (RWR)

49424 (DOE/TIC—10142) **Laramie Energy Technology Center annual report 1978.** Fumich, G. Jr. (Department of Energy, Laramie, WY (USA). Laramie Energy Research Center). 23 Aug 1978. 63p. Dep. NTIS, PC A04/MF A01.

Laramie Energy Technology Center's research efforts in the areas of oil shale, tar sand, and coal are discussed. Various activities in the Office of Research and Development are reported.

MATHEMATICS AND COMPUTERS

49425 (LA—5525-M(Vol.5)) **common file system reference manual. PIM-5.** (Los Alamos Scientific Lab., NM (USA)). Jun 1979. Contract W-7405-ENG-36. 117p. Dep. NTIS, PC A06/MF A01.

Part 1 of this manual consists of a single chapter that contains a brief overview of the features of the Common File System. The next two parts give more specific information about how to use the Common File System. Part 2 focuses on the structure of the file organization. Part 3 describes a utility called MASS, which is used to access the Common File System.

49426 (LA—7887-M) **User's manual for LASL shock Hugoniot data file.** Hoyt, M.S. (Los Alamos Scientific Lab., NM (USA)). Jul 1979. Contract W-7405-ENG-36. 21p. Dep. NTIS, PC A02/MF A01.

Tape, photostore, and Common File System access instructions for the equation-of-state file HUGDATA are given. The data format is described, and an example shows how to extract data on specific materials for use as code input.

49427 (SAND—79-0237) **Particle tracing code for multispecies gas.** Eaton, R.R.; Fox, R.L.; Vandevender, W.H. (Sandia Labs., Albuquerque, NM (USA)). Jun 1979. Contract EY-76-C-04-0789. 24p. Dep. NTIS, PC A02/MF A01.

Details are presented for the development of a computer code designed to calculate the flow of a multispecies gas mixture using particle tracing techniques. The current technique eliminates the need for a full simulation by utilizing local time averaged velocity distribution functions to obtain the dynamic properties for probable collision partners. The development of this concept reduces statistical scatter experienced in conventional Monte Carlo simulations. The technique is applicable to flow problems involving gas mixtures with disparate masses and trace constituents in the Knudsen number, Kn, range from 1.0 to less than 0.01. The resulting code has previously been used to analyze several aerodynamic isotope enrichment devices.

49428 (UCRL—81185) **SLIC: an interactive mesh generator for finite element and finite difference application programs.** Gerhard, M.A.; Greenlaw, R.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Jun 1979. Contract W-7405-ENG-48. 14p. (CONF-790827—3). Dep. NTIS, PC A02/MF A01.

From ADINA conference; Cambridge, MA, USA (1 Aug 1979).

Computers with extended memory, such as the CDC STAR 100 and the CRAY 1 with mega-word capacities, are greatly enlarging the size of finite-element problems which can be solved. But the cost of developing and testing large meshes can be prohibitive unless one uses a computer program for mesh generation and plotting. SLIC is an interactive mesh program which builds 2- and 3-D continuum meshes from interactive terminal or disc input. The user inputs coordinates for certain key points and enters commands which complete the description of the geometry. Entire surfaces and volumes are then generated from the geometric skeleton. SLIC allows the user to correct input errors and saves the corrected command list for later reuse. The mesh can be plotted on a video display at any stage of development to evaluate the work in progress. Output is in the form of an input file to a user-selected computer code. Among the available output types are ADINA, SAP4, and NIKE2D. 12 figures.

CIVILIAN DEFENSE

REFER ALSO TO CITATION(S) 49092, 49093, 49094, 49097, 49098

49429 (AD-A—061425) **Organizational relocation. Final report.** Chenault, W.W.; Davis, C.H. (Human Sciences Research, Inc., McLean, VA (USA)). Sep 1978. Contract DCPA01-76-C-0322. 194p. NTIS PC A09/MF A01.

This document describes the rationale and recommended planning procedures for relocating intact organizations during a very severe crisis or massive disaster. Part One presents a rationale and recommended planning approach. Part Two describes detailed planning guidance, forms, and illustrative content. Part Three is a summary planning format, with accompanying instructions. The three parts are paginated separately for separate use in diverse circumstances.

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In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the report title and the volume and abstract numbers. Report numbers, if applicable, are given in parentheses at the end of the entry.

DOE Energy Information Data Base: Corporate Author Entries (TID-4585) is used in the standardization of corporate entries. TID-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

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The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed.

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613-2215	4:48889	Dep. NTIS, PC A02/MF A01
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79/2	4:48100	Dep. NTIS, PC A07/MF A01
1812-1	4:48099	Dep. NTIS, PC A04/MF A01
BGC-T-		
4290	4:48653	British Gas, London, England
BM-IC-		
8796	4:48171	Bureau of Mines, Washington, DC
8806	4:48069	Bureau of Mines, Washington, DC
BM-RI-		
8341	4:48808	Bureau of Mines, Washington, DC
8357	4:48961	NTIS
BMFT-FBT-		
79-02	4:48333	Dep. NTIS (US Sales Only), PC A11/MF A01
79-04	4:48510	Dep. NTIS (US Sales Only), PC A07/MF A01
BMI-		
2027	4:48714	*See* NUREG/CR-0872
2028	4:48712	*See* NUREG/CR-0845
BNL-		
25771	4:48936	Dep. NTIS, PC A02/MF A01

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25806	4:49387	Dep. NTIS, PC A02/MF A01
25941	4:49072	Dep. NTIS, PC A02/MF A01
25999	4:49021	Dep. NTIS, PC A02/MF A01
26069	4:49260	Dep. NTIS, PC A02/MF A01
26111	4:48974	Dep. NTIS, PC A03/MF A01
26114	4:49035	Dep. NTIS, PC A02/MF A01
26216	4:48478	Dep. NTIS, PC A02/MF A01
26217	4:48334	Dep. NTIS, PC A02/MF A01
26219	4:48479	Dep. NTIS, PC A02/MF A01
26241	4:49036	Dep. NTIS, PC A02/MF A01
26242	4:48505	Dep. NTIS, PC A02/MF A01
26250	4:49037	Dep. NTIS, PC A02/MF A01
26326	4:49038	Dep. NTIS, PC A02/MF A01
26368	4:49039	Dep. NTIS, PC A02/MF A01
26369	4:49117	Dep. NTIS, PC A02/MF A01
26379	4:49362	Dep. NTIS, PC A02/MF A01
26392	4:48899	Dep. NTIS, PC A03/MF A01
26432	4:49358	Dep. NTIS, PC A02/MF A01
50814	4:48742	Dep. NTIS, PC A03/MF A01
50887	4:48515	Dep. NTIS, PC A07/MF A01
50990	4:49012	Dep. NTIS, PC A03/MF A01
BNL-NUREG-		
25493	4:48686	Dep. NTIS, PC A03/MF A01
25522	4:48687	Dep. NTIS, PC A02/MF A01
25603	4:49238	Dep. NTIS, PC A02/MF A01
25844	4:48688	Dep. NTIS, PC A02/MF A01
25845	4:48689	Dep. NTIS, PC A02/MF A01
25862	4:48654	Dep. NTIS, PC A02/MF A01
50965	4:48212	*See* NUREG/CR-0707
CAAP-TR-		
052	4:48690	Dep. NTIS, PC A03/MF A01
CALT-		
63-304	4:49322	Dep. NTIS, PC A03/MF A01
CDAP-TR-		
056	4:48549	Dep. NTIS, PC A03/MF A01
CEA-CONF-		
3991	4:48562	Dep. NTIS (US Sales Only), PC A04/MF A01
CONF-7610168-	(European conference on living systems as energy converters, Pont-'a-Mousson, France, 18-22 Oct 1976)	
	4:49210	New York, NY; Elsevier/ North-Holland, Inc. (1977).
CONF-770385-	(Workshop on the global effects of carbon dioxide from fossil fuels, Miami Beach, FL, USA, 7-11 Mar 1977)	
	4:49103	Dep. NTIS, PC A07/MF A01
CONF-7705166-	(French-Soviet colloquium on the operation of power plants equipped with water reactors, Moscow, USSR, 31 May-10 Jun 1977)	
1	4:48562	*See* CEA-CONF-3991
CONF-770926-	(23. annual conference on bioassay, environmental and analytical chemistry, Moran, WY, USA, 15-16 Sep 1977)	
(absts)	4:48958	*See* IDO-12083
CONF-7710197-	(1. international conference and work shops on iceberg utilization for fresh water production, weather modification and other applications, Ames, IA, USA, 2-6 Oct 1977)	
	4:48330	Elmsford, NY; Pergamon Press, Inc. (1978).
CONF-771120-	(Winter annual meeting of the American Society of Mechanical Engineers, Atlanta, GA, USA, 27 Nov-2 Dec 1977)	
P6	4:48545	ASME, United Engineering Center, 345 E. 47th St., New York, NY
CONF-7711121-	(Indo-German seminar on radiation damage, Kalpakkam, India, 14-16 Nov 1977)	
	4:48937	Dep. NTIS (US Sales Only), PC A22/MF A01
CONF-771212-	(Symposium on the safety of nuclear ships, Hamburg, F.R. Germany, 5-9 Dec 1977)	
	4:48721	Paris, France; OECD (1978).
CONF-771222-	(IAEA symposium on natural fission reactors, Paris, France, 19-21 Dec 1977)	
21(Trans)	4:48158	*See* LA-tr-78-69
CONF-780266-	(13. biennial national industrial electric heating conference, Cincinnati, OH, USA, 6-8 Feb 1978)	
	4:48857	Electrification Council, 90 Park Ave., New York, NY 10016
CONF-7804136-	(Conference on spent fuel policy and its implications, Buford, GA, USA, 2-5 Apr 1978)	
	4:48227	La Grange Park, IL; American Nuclear Society (Apr 1978).
CONF-7804144-	(Nordic spring symposium on inner shell phenomena, Geilo, Norway, 17-21 Apr 1978)	
1	4:49322	*See* CALT-63-304
CONF-780545-	(Meeting of the American Ceramic Society, Detroit, MI, USA, 6-11 May 1978)	
10	4:48638	*See* HEDL-SA-1399-FP
CONF-7805179-	(An energy assembly, Albany, NY, USA, 23 May 1978)	
	4:48765	Albany, NY; Legislative Commission on Science and Technology (1978).
CONF-780708-	(Geothermal Resources Council meeting, Hilo, HI, USA, 25-28 Jul 1978)	
27	4:48504	*See* DOE/ET/28451-4
CONF-780718-	(7. cryogenic engineering conference, South Kensington, London, UK, 4-7 Jul 1978)	
	4:48992	IPC Science and Technology Press, Guildford, Surrey, England
CONF-780732-	(Metallographic Society Technical conference, Montreal, Canada, 16-19 Jul 1978)	
6	4:48064	Dep. NTIS, PC A02/MF A01
CONF-780826-	(19. conference on high energy physics, Tokyo, Japan, 23-31 Aug 1978)	
34	4:49338	*See* COO-2232A-69
CONF-7808110-	(6. international conference on atomic physics, Riga, USSR, 17-22 Aug 1978)	
1	4:49330	*See* COO-4264-3
CONF-780953-	(10. symposium on fusion technology, Padova, Italy, 4-8 Sep 1978)	
12	4:49381	*See* NRL-MR-4029
CONF-7809163-	(New York state energy conference, New York, NY, USA, 20-21 Sep 1978)	
	4:48735	New York, NY; New York State Energy Office (1978).
CONF-781001-	(3. US-USSR LMFBR steam generator seminar, Tampa, FL, USA, Oct 1978)	
P1	4:48588	AT
P2	4:48601	AT
CONF-781051-	(Symposium of northeastern accelerator personnel, Oak Ridge, TN, USA, 23-25 Oct 1978)	
	4:49040	Dep. NTIS, PC A18/MF A01
CONF-7810116-	(Bartol conference on cosmic rays and particle physics above 10 TeV, Newark, DE, USA, 16-21 Oct 1978)	
	4:49299	New York, NY; American Institute of Physics (1979).
CONF-7810170-	(2. international well-testing symposium, Berkeley, CA, USA, 25-27 Oct 1978)	
3	4:48492	*See* UCRL-81506
CONF-7810187-	(31. annual gaseous electronics conference, Buffalo, NY, USA, 17-20 Oct 1978)	
(absts)	4:49335	Dep. NTIS, PC A08/MF A01
CONF-781121-	(Annual meeting of Materials Research Society, Boston, MA, USA, 28 Nov-1 Dec 1978)	
	4:48941	New York, NY; American Institute of Physics (1979).
CONF-7811130-	(Distribution automation and control working group, Baltimore, MD, USA, 20-22 Nov 1978)	
P1(Summ.)	4:48542	*See* JPL-PUB-79-35(Vol.1)
CONF-781220-	(Second solar heating and cooling commercial demonstration program contractor's review, San Diego, CA, USA, 13-15 Dec 1978)	
	4:48337	*See* HCP/M4131-01
CONF-781247-	(2. international conference on energy storage, compression and switching, Venice, Italy, 5-8 Dec 1978)	
4	4:49371	*See* UCRL-81907
CONF-790107-	(3. national conference and exhibition on technology for energy conservation, Tucson, AZ, USA, 22-26 Jan 1979)	
10	4:48480	*See* LBL-8703
CONF-790122-	(Annual meeting of the American Association for the Advancement of Science, Houston, TX, USA, 3-8 Jan 1978)	

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3	4:48266	*See* SERI/TP-52-138
CONF-790125-	(1. topical meeting on fusion reactor materials, Miami Beach, FL, USA, 29-31 Jan 1979)	
71	4:49418	Dep. NTIS, PC A02/MF A01
72	4:49419	Dep. NTIS, PC A02/MF A01
75	4:48250	*See* UCRL-81415(Rev.1)
76	4:49420	Dep. NTIS, PC A02/MF A01
CONF-790127-	(Workshop on analysis of hydrogen in solids, Albuquerque, NM, USA, 23-25 Jan 1979)	
	4:48884	*See* DOE/ER-0026
CONF-790207-	(10. symposium on explosives and pyrotechnics, San Francisco, CA, USA, 14-16 Feb 1979)	
6	4:48966	*See* MLM-2627(OP)
CONF-790209-	(12. Health Physics Society midyear topical symposium, Williamsburg, VA, USA, 12-15 Feb 1979)	
7	4:48237	Dep. NTIS, PC A02/MF A01
8	4:48220	*See* RHO-SA-99
CONF-790317-	(Thermal characteristics of tumors, New York, NY, USA, 14-16 Mar 1979)	
1	4:49238	*See* BNL-NUREG-25603
CONF-790318-	(Symposium on nonlinear dynamics and the beam-beam interaction, Upton, NY, USA, 19-21 Mar 1979)	
3	4:49069	*See* SLAC-PUB-2313
5	4:49070	*See* SLAC-PUB-2320
CONF-790327-	(IEEE particle accelerator conference, San Francisco, CA, USA, 12-14 Mar 1979)	
120	4:49027	*See* LBL-8385
152	4:49021	*See* BNL-25999
153	4:49061	*See* LBL-8411
154	4:49028	*See* SLAC-PUB-2279
CONF-790334-	(Oil shale symposium, Denver, CO, USA, 26-28 Mar 1979)	
11	4:48153	*See* LBL-8901
CONF-790363-	(US Japan specialist meeting on high temperature piping design and analysis, Pittsburgh, PA, USA, 26-30 Mar 1979)	
5	4:48616	AT
CONF-790365-	(16. rencontre de moriond, Les Arcs, Savoie, France, 17-23 Mar 1979)	
4	4:49342	*See* LBL-9015
CONF-790370-	(5. international conference on structural mechanics in reactor technology, Berlin, F.R. Germany, 20 Mar 1979)	
1	4:48617	Dep. NTIS, PC A02/MF A01
CONF-790376-	(106. D.E.A.G. meeting, Frankfurt, F.R. Germany, 20-23 Mar 1979)	
1	4:49089	*See* UCRL-82395
CONF-790377-	(Highly specialized seminars, probing hadrons with leptons, Sicily, Italy, 13-21 Mar 1979)	
1	4:49066	*See* SLAC-PUB-2340
CONF-790379-	(Hydropower: a national energy resource workshop, Easton, MD, USA, 11-16 Mar 1979)	
1	4:48264	Dep. NTIS, PC A02/MF A01
CONF-790381-	(10. lunar and planetary science conference, Houston, TX, USA, 19-23 Mar 1979)	
1	4:49302	Dep. NTIS, PC A03/MF A01
2	4:49298	*See* LA-UR-79-1582
CONF-790402-	(Computational methods in nuclear engineering, Williamsburg, VA, USA, 23-25 Apr 1979)	
24	4:48579	Dep. NTIS, PC A02/MF A01
CONF-790413-	(International solar-terrestrial predictions workshop, Boulder, CO, USA, 23-27 Apr 1979)	
4	4:49313	*See* LA-UR-79-1660
CONF-790415-	(177. ACS national meeting, Honolulu, HI, USA, 1-6 Apr 1979)	
39	4:48254	Institute of Gas Technology, 3424 South State Street, IIT Center, Chicago, IL
CONF-790420-	(International symposium on ceramics in nuclear waste management, Cincinnati, OH, USA, 30 Apr-2 May 1979)	
16	4:48668	*See* HEDL-SA-1690-FP
18	4:48198	*See* DP-MS-78-90
19	4:48176	*See* HEDL-SA-1694-FP
CONF-790423-	(2. multiphase flow and heat transfer symposium workshop, Miami Beach, FL, USA, 16-18 Apr 1979)	
14	4:48096	*See* NYU/DAS-79-02
CONF-790442-	(International conference on metallurgical coatings, San Diego, CA, USA, 23-27 Apr 1979)	
15	4:48251	*See* UCRL-81842
CONF-790444-	(Offshore technology conference, Houston, TX, USA, 30 Apr-4 May 1979)	
3	4:48329	*See* SERI/TP-34-180
CON₄ -790457-	(1979 photovaltaic solar energy conference, West Berlin, F.R. Germany, 23-26 Apr 1979)	
2	4:48284	*See* SAND-78-2187C
3	4:48283	*See* SAND-78-2186C
4	4:48276	*See* DOE/NASA/20485-79/1
CONF-790458-	(Symposium on environmental and climatic impact of coal utilization, Williamsburg, VA, USA, 17-19 Apr 1979)	
3	4:48538	*See* UCRL-82761
CONF-790473-	(Value engineering workshop, DOE, Germantown, MD, USA, 4-5 Apr 1979)	
1	4:49018	*See* UCRL-82712
CONF-790477-	(Annual meeting of national organization for the professional advancement of black chemists and chemical engineers, Houston, TX, USA, 18-21 Apr 1979)	
1	4:48070	Dep. NTIS, PC A02/MF A01
CONF-790480-	(12. symposium on nondestructive evaluation, San Antonio, TX, USA, 24-26 Apr 1979)	
1	4:48042	Dep. NTIS, PC A02/MF A01
CONF-790485-	(Stereodynamics of molecular systems symposium, Albany, NY, USA, 23-24 Apr 1979)	
2	4:49203	Dep. NTIS, PC A03/MF A01
CONF-790488-	(2. PEWG specialists - meeting, Richland, WA, USA, 23-26 Apr 1979)	
7	4:48680	*See* HEDL-SA-1676
CONF-790491-	(International conference on martensitic transformations, Boston, MA, USA, 24-29 Jun 1979)	
1	4:48904	*See* LBL-9058
CONF-790493-	(Electric Power Research Institute cogeneration workshop, San Antonio, TX, USA, 1-4 Apr 1979)	
1	4:48862	Dep. NTIS, PC A02/MF A01
CONF-790501-	(Wind energy innovative systems conference, Colorado Springs, CO, USA, 23-25 May 1979)	
1	4:48512	*See* SERI/TP-35-263
CONF-790505-	(25. ISA international instrumentation symposium, Anaheim, CA, USA, 7-9 May 1979)	
14	4:49083	Dep. NTIS, PC A03/MF A01
CONF-790512-	(14. world gas conference, Toronto, Canada, 27 May-1 Jun 1979)	
4	4:48058	Institute of Gas Technology, 3424 South State Street, IIT Center, Chicago, IL
CONF-790520-	(3. international alcohol fuels technology, Asilomar, CA, USA, 28-31 May 1979)	
2	4:48881	Dep. NTIS, PC A02/MF A01
5	4:48882	Dep. NTIS, PC A02/MF A01
CONF-790524-	(6. international congress symposium on radiation research and stem cells, Tokyo, Japan, 13-19 May 1979)	
8	4:49326	Dep. NTIS, PC A02/MF A01
CONF-790529-	(Conference on Optics, Los Alamos, NM, USA, 23-25 May 1979)	
1	4:49001	*See* LA-UR-79-1032
CONF-790537-	(Cold Spring Harbor symposium on quantitative mammalian cell mutagenesis and mutagen screening, Cold Springs Harbor, NY, USA, 6-9 May 1979)	
3	4:49235	Dep. NTIS, PC A02/MF A01
CONF-790538-	(Fast ion transport in solids-electrode and electrolytes conference, Lake Geneva, WI, USA, 21-25 May 1979)	
12	4:49359	Dep. NTIS, PC A02/MF A01
13	4:49329	Dep. NTIS, PC A02/MF A01
CONF-790540-	(2. international conference on megagauss magnetic field generation and related topics, Washington, DC, USA, 29 May-1 Jun 1979)	
13	4:49391	*See* UCRL-82142
14	4:49366	*See* SAND-79-1093C
CONF-790541-	(International Solar Energy Society meeting, Atlanta, GA, USA, 28 May 1979)	
7	4:48458	*See* LA-UR-79-1336
10	4:48455	*See* CONF-790570-1
22	4:48334	*See* BNL-26217

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23	4:48101	Dep. NTIS, PC A02/MF A01
25	4:48478	*See* BNL-26216
27	4:48479	*See* BNL-26219
38	4:48282	*See* SAND-78-2181C
39	4:48286	*See* SAND-79-1165C
CONF-790545-	(Time-dependent Hartree-Fock international workshop, Gif-sur-Yvette, France, 28 May-1 Jun 1979)	
2	4:49345	Dep. NTIS, PC A02/MF A01
3	4:49346	Dep. NTIS, PC A02/MF A01
CONF-790547-	(Electrochemical Society meeting, Boston, MA, USA, 7-11 May 1979)	
1	4:48285	*See* SAND-79-1008C
CONF-790550-	(Energy and environmental technology training conference, Tsaile, AZ, USA, 29-30 May 1979)	
2	4:48071	*See* LA-UR-79-1674
CONF-790557-	(Livestock conservation institute meeting, Kansas City, MO, USA, 7-10 May 1979)	
1	4:49086	*See* LA-UR-79-1180
CONF-790558-	(Ultra short laser pulses meeting, London, UK, 23-24 May 1979)	
1	4:49002	*See* LA-UR-79-1203
CONF-790559-	(Powder and bulk solids conference and exhibition, Philadelphia, PA, USA, 15-17 May 1979)	
2	4:48090	Institute of Gas Technology, 3424 South State Street, IIT Center, Chicago, IL
CONF-790562-	(Radiation effects on aquatic organisms, Tokyo, Japan, May 1979)	
1	4:49260	*See* BNL-26069
CONF-790563-	(International prostaglandin conference, Washington, DC, USA, 27-31 May 1979)	
1	4:49204	Dep. NTIS, PC A02/MF A01
CONF-790568-	(MINITECH 1, SME, Chicago, IL, USA, 22 May 1979)	
1	4:48889	*See* BDX-613-2215
CONF-790570-	(Solar Thermal Test Facility Users Association experiments workshop, Albuquerque, NM, USA, 3-4 May 1979)	
1	4:48455	Dep. NTIS, PC A02/MF A01
CONF-790571-	(6. national conference on energy and the environment, Pittsburgh, PA, USA, 21-24 May 1979)	
2	4:49117	*See* BNL-26369
4	4:48059	Institute of Gas Technology, 3424 South State Street, IIT Center, Chicago, IL
CONF-790572-	(Helium Breeder Associates/US Dept of Energy GCFR technical meeting, San Diego, CA, USA, 30 May-1 Jun 1979)	
2	4:48580	Dep. NTIS, PC A02/MF A01
CONF-790575-	(ASME - materials engineering conference, Washington, DC, USA, 8-11 May 1979)	
1	4:48918	*See* KAPL-4105
CONF-790578-	(Hazardous materials American Defense Preparedness Association, Albuquerque, NM, USA, 15-17 May 1979)	
1	4:49090	*See* UCRL-82675(Rev.1)
CONF-790580-	(ACS/CSJ chemical congress, Honolulu, HI, USA, 4 May 1979)	
1	4:48482	Dep. NTIS, PC A02/MF A01
CONF-790583-	(Gas dynamics conference, Livermore, CA, USA, 22-23 May 1979)	
1	4:49333	*See* UCRL-82801
CONF-790592-	(International conference on the structure of medium-heavy nuclei, Rhodos, Greece, 1-4 May 1979)	
1	4:49344	*See* LBL-9212
CONF-790602-	(ANS annual meeting, Atlanta, GA, USA, 3-8 Jun 1979)	
45	4:48185	*See* RFP-2928
49	4:48200	*See* DP-MS-78-100
67	4:48959	*See* MLM-2602(OP)
68	4:48243	*See* SAND-79-1196C
70	4:48957	Dep. NTIS, PC A02/MF A01
73	4:48199	*See* DP-MS-78-97
CONF-790611-	(AIAA terrestrial energy systems conference, Orlando, FL, USA, 4-6 Jun 1979)	
4	4:48509	*See* DOE/NASA/1028-79/23
CONF-790615-	(3. US national congress on pressure vessels and piping, San Francisco, CA, USA, 25-29 Jun 1979)	
15	4:48691	Dep. NTIS, PC A02/MF A01
CONF-790619-	(3. IMACS international symposium on computer methods for partial differential equation, Bethlehem, PA, USA, 20-22 Jun 1979)	
2	4:49024	Dep. NTIS, PC A02/MF A01
CONF-790620-	(Dundee conference on application of numerical analysis, Dundee, UK, 26-29 Jun 1979)	
2	4:49360	Dep. NTIS, PC A02/MF A01
CONF-790622-	(Pulsed power conference, Lubbock, TX, USA, 12-14 Jun 1979)	
4	4:49064	*See* SAND-79-0718C
7	4:49399	*See* SAND-79-0933C
13	4:49073	*See* LA-UR-79-1571
14	4:49397	*See* SAND-79-0730C
20	4:49401	*See* UCRL-82479
21	4:49413	*See* UCRL-82539
22	4:49402	*See* UCRL-82661
23	4:49400	*See* UCRL-82473
24	4:49063	*See* SAND-79-0698C
CONF-790625-	(14. carbon conference, University Park, PA, USA, 25-29 Jun 1979)	
6	4:48074	Dep. NTIS, PC A02/MF A01
CONF-790631-	(6. OTEC conference, Washington, DC, USA, 19-22 Jun 1979)	
7	4:48328	*See* LBL-9052
CONF-790632-	(JOWOG-28, Albuquerque, NM, USA, 11-14 Jun 1979)	
7	4:48951	*See* SAND-79-0962C
CONF-790642-	(International conference on high energy physics, Geneva, Switzerland, 27 Jun-4 Jul 1979)	
2	4:49339	*See* SLAC-PUB-2350
3	4:49340	*See* LBL-9348
CONF-790645-	(IEEE international conference on plasma science, Montreal, Canada, 4-6 Jun 1979)	
1	4:49370	*See* UCRL-82158
CONF-790649-	(1. international conference on the future of heavy crude and tar sands, Edmonton, Canada, 4-12 Jun 1979)	
1	4:48105	*See* SAND-79-1023
CONF-790651-	(National conference on synchrotron radiation instrumentation, Gaithersburg, MD, USA, 4-6 Jun 1979)	
3	4:49037	*See* BNL-26250
5	4:49035	*See* BNL-26114
CONF-790653-	(Superconductivity in d- and f-band metals, San Diego, CA, USA, 21-23 Jun 1979)	
1	4:48936	*See* BNL-25771
2	4:48900	Dep. NTIS, PC A02/MF A01
3	4:49363	Dep. NTIS, PC A02/MF A01
4	4:49364	Dep. NTIS, PC A02/MF A01
5	4:48901	Dep. NTIS, PC A02/MF A01
7	4:49362	*See* BNL-26379
CONF-790655-	(Colloquium on two-phase instrumentation, Idaho Falls, ID, USA, 11-14 Jun 1979)	
3	4:48677	Dep. NTIS, PC A03/MF A01
4	4:49004	Dep. NTIS, PC A04/MF A01
6	4:48550	Dep. NTIS, PC A03/MF A01
CONF-790658-	(27. annual conference on mass spectrometry and allied topics, Seattle, WA, USA, 3-8 Jun 1979)	
4	4:49084	Dep. NTIS, PC A02/MF A01
CONF-790660-	(Conference on large amplitude collective nuclear motion, Lake Balaton, Hungary, 10-16 Jun 1979)	
1	4:49347	Dep. NTIS, PC A02/MF A01
3	4:49348	*See* LA-UR-79-1511
4	4:49350	*See* LBL-9244
CONF-790662-	(5. international conference on excess electrons and metal-ammonia solutions, Iverness-Shire, UK, 25-29 Jun 1979)	
1	4:48974	*See* BNL-26111
CONF-790663-	(Symposium on analysis of waters associated with alternate fuel production, Pittsburgh, PA, USA, 4-5 Jun 1979)	
1	4:48956	Dep. NTIS, PC A02/MF A01
CONF-790664-	(70. annual meeting of special libraries association, physics-astronomy-mathematics division, Honolulu, HI, USA, 9-14 Jun 1979)	
1	4:49367	Dep. NTIS, PC A02/MF A01
CONF-790666-	(34. Northwest regional meeting of the American Chemical Society, Richland, WA, USA, 13-15 Jun 1979)	
1	4:48175	Dep. NTIS, PC A04/MF A01

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CONF-790668-	(DOE weapons complex annual adhesives conference, Amarillo, TX, USA, 5-6 Jun 1979)	
2	4:48953	*See* UCRL-82694
CONF-790670-	(IEEE international symposium on application of ferroelectric, Minneapolis, MN, USA, 13-15 Jun 1979)	
1	4:48995	*See* SAND-79-0147C
CONF-790671-	(4. international conference on ion beam analysis, Aarhus, Denmark, 25-29 Jun 1979)	
1	4:49353	*See* LA-UR-79-1435
2	4:49351	*See* SAND-79-0684C
CONF-790672-	(International symposium on modeling, planning, and decision in energy systems, Montreux, Switzerland, 19-21 Jun 1979)	
1	4:48505	*See* BNL-26242
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1	4:49354	*See* UCRL-82684
2	4:49038	*See* BNL-26326
CONF-790675-	(3. annual conference on transport processes in laser plasmas, Traverse City, MI, USA, 18-21 Jun 1979)	
1	4:49356	*See* UCRL-82792
CONF-790676-	(Conference on DNA repair and mutagenesis in bacteria, Atlanta, GA, USA, 25-28 Jun 1979)	
2	4:49261	Dep. NTIS, PC A02/MF A01
3	4:49256	Dep. NTIS, PC A04/MF A01
CONF-790678-	(ASHRAE society meeting, Detroit, MI, USA, 24-28 Jun 1979)	
1	4:48826	Dep. NTIS, PC A03/MF A01
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1	4:48501	*See* UCRL-82814
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1	4:48943	Dep. NTIS, PC A02/MF A01
2	4:48903	*See* LBL-8096
3	4:48945	*See* UCRL-82515
4	4:48896	*See* UCRL-82865
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1	4:48223	*See* SAND-79-1275C
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1	4:49007	*See* COO-4094-56
CONF-790704-	(12. AIAA fluid and plasma dynamics conference, Williamsburg, VA, USA, 24-26 Jul 1979)	
1	4:48982	*See* UCRL-82131
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4	4:48241	*See* LA-UR-79-789
8	4:48239	Dep. NTIS, PC A02/MF A01
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10	4:48247	*See* UCRL-82335
13	4:48246	*See* UCRL-82213
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1	4:49065	*See* SLAC-PUB-2307
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1	4:49331	*See* LBL-8946
2	4:49332	*See* SAND-79-8679
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7	4:49412	*See* SAND-79-0734C
8	4:49414	*See* UCRL-82586
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33	4:48310	*See* SAND-79-1126C
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CONF-790828-	(7. international colloquium on gas-dynamics of explosions and reactive systems, Gottingen, F.R. Germany, 20-24 Aug 1979)	

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